

PHOTO —
GRAPHIC
INSTRUC-
TION.....
TEXT.....

Photographic Instruction Text

A SYSTEMATIC COURSE AND
WORKING GUIDE IN ALL THE
PROCESSES WHICH ORDIN-
ARILY TAKE UP THE ATTEN-
TION OF CAMERA WORKERS

BY

GEO. H. PALTRIDGE, INSTRUCTOR IN PHOTOGRAPHY

LEWIS INSTITUTE, CHICAGO



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PHOTOGRAPHIC INSTRUCTION TEXT.

CHAPTER I.

Introductory. These notes are designed to give systematic, practical instruction and useful information to camera workers.

They are the outgrowth of photographic instruction work before numerous classes and individual students, and combine the experience of studio practice with instruction training. Frequent contact with camerists has developed a knowledge of their customary needs and mapped out a course for systematic training and connected information which may supplant the usual store of miscellaneous experience and disconnected facts. It is intended to acquaint one with practice and reasons in a logical order and to give a systematic knowledge which will enable an old or new worker to work intelligently, and will set one on a basis from which, if desired, he may advantageously follow a more advanced treatise supplementary to this publication. The matter is laid in form that puts one in touch with the actual conditions from which conclusions are drawn and methods derived. On the other hand, some attempt is made to set forth the conclusions and methods in such form that those to whom exacting work would prove tedi-

ous or who have not the facilities for it, may get the information without practice.

For the convenience of those who would use this as a text book, the chapters are so arranged that a continuous and systematic course may be had by following them in the order indicated on the first page of chapter II. For general reading purposes, the matter can be followed in its printed order and for reference purposes, the subjects are laid out with definite sub-headings under the general classification of Negative Making and Positive Making.

Proficiency in any line of photographic work must be got by close observation and a knowledge of fundamental facts and principles. The method of this work is therefore laid on lines which will help the reader to such observation and toward handling difficulties from a basis of facts and principles.

The notes are not meant to direct one to the purchase or use of any particular plates, papers, or cameras. In fact, they aim to be strictly free from anything that could make them a trade publication. Moreover, any recommendations might lose their value in a short time as advancing products of The Trade supercede those which could now be justly recommended. But tangible examples are necessary. Therefore, reliable goods and only such are freely mentioned merely as types of what is being described. The types are chosen entirely from the standpoint of help for the reader, every other consideration being eliminated. So, having seen the type, make it a point, if it be apparatus, to get apparatus which has

the parts or attachments described, not necessarily the one indicated as a type. In short, the descriptions aim to tell what fittings must be had, the particular manufacture under which they come being only a matter for one's decision from a business standpoint.

**The Choice
of a
Camera.**

There are two general classes of cameras—folding and hand. Folding cameras are those which open at one end to form a bed on which the lens may be brought forward or folded back into camera by means of a bellows. Hand cameras are those in which the lens is not attached to a bellows but remains stationary in a box. They are fixed focus instruments, which means that without bellows adjustment, a sharply defined picture can be taken of everything beyond a specified distance.

In other respects, hand and folding cameras need not differ. Either one may be a film or a plate camera, and the same camera is sometimes adjustable to both plates and films. Magazine cameras are hand cameras which, as the name is supposed to indicate, will hold a number of plates, usually twelve, enabling one to expose that number of plates without resort to a dark room.

Every camera is fitted with a shutter, which is a device for opening and closing the aperture of a lens and for controlling the duration of an exposure. Most cameras are fitted with a diaphragm which increases and decreases the size of the lens opening. Some of the cheaper cameras have no

diaphragms, the full aperture being used on all occasions.

Convenience is the primary object in hand cameras. Their fixed, or universal focus, whereby everything beyond a certain number of feet is sharply defined, dispenses with the delay of focusing and therefore, hand cameras are preferable for snap shot work and traveling. But in folding cameras, working points take precedence of convenience. So that the choice of a camera becomes first a choice between convenience and adaptibility to the best class of work. Decide first whether to get a hand camera or a folding camera. The rest depends upon what you wish to invest.

Say your choice is a hand camera. Hand cameras are made to use plates only (magazine), films only, or plates and films. In any case, do not get one for films only, unless you have more than one camera, because a whole roll of twelve exposures must be made before developing and often one wishes to make and develop a couple exposures without waiting until the whole roll is exposed. Moreover, plates are more convenient to handle in developing and printing and should be preferred to films, except when extended trips make the film necessary. A film-and-plate camera is the best hand camera to get, since when it is to be used for only a few exposures, the weight and bulk of plates is inconsiderable and when many exposures are to be made, the use of film still prevents weight and bulk. Such a camera averages in price from \$12 to \$20. An Eastman No. 2

Bullet Special is a good example. The plate hand cameras are cheaper, ranging from \$6 to \$15. They make as good a picture as the more expensive film-and-plate outfit, but are heavier and larger. So if you wish to economize, get a plate hand camera.

After narrowing down to the general class of camera within your price, some attention should be paid to adjustments. To be of much general use, a hand camera should have at least enough shutter adjustment to make a fast instantaneous, a slow instantaneous and a time exposure, or have several sizes of opening for lens with simply instantaneous and time exposures. Either of these will do, but a third class having only one size opening for lens and simply instantaneous and time exposures are not adapted to even general amateur work. The best hand cameras have adjustments for at least three openings and the three exposures specified. See the '99 Cyclone Nos. 4 and 5, and '99 Adlake Special.

If your choice is a folding camera, the field of further choice is much wider than if it were a hand camera, the choice varying greatly as regards shape, ranging in size of pictures made from $3\frac{1}{2} \times 3\frac{1}{2}$ to $6\frac{1}{2} \times 8\frac{1}{2}$ and in price from \$10 to \$50 and higher.

The difference in shape is owing, in most cases, to an attempt at convenience whereby, instead of the ordinary shape, some boxes are made flatter to save bulk and to carry more easily on a wheel. The Cartridge Kodak and Cycle Poco cameras are examples. Unless a flat shape is especially desired, it is better to get the square built box, because fittings, or firm-

ness, or strength is compromised for the convenient shape. Whether your camera shall be a $3\frac{1}{2} \times 3\frac{1}{2}$, 4×5 , 5×7 , or $6\frac{1}{2} \times 8\frac{1}{2}$ depends entirely upon what size picture you prefer, how bulky an outfit you can carry, and what you can pay for. Remember that the original extra cost of a larger size is only an index of its extra working cost. For instance, 4×5 plates list at 65 cents a dozen; 5×7 , at \$1.10; $6\frac{1}{2} \times 8\frac{1}{2}$, at \$1.65. And likewise with paper and mounts. The 4×5 is mostly used and is best adapted to an amateur's wants in points of use, ease and economy. The price of a 4×5 folding camera varies in the main from \$10 to \$35. The necessary fittings for a good serviceable camera of average price (\$15 to \$20) are the rising and falling front, vertical back swing, rack and pinion and adequate adjustment for diaphragm and shutter movement. Such a camera can be seen in the Premo A or the Poco B. A film attachment can be purchased for most folding cameras and at any time. It is well to make sure when purchasing that your camera will take a film attachment in case you need one at a later time. Lenses vary somewhat with the price of camera. Any of those in the medium priced cameras are to be relied upon.

As to the parts mentioned: The rising and falling front is for raising and lowering a lens toward a view not on a level with the camera, the back swing is to place the ground glass in such a position that outlines will not be distorted, and the rack and pinion is a thumb screw and ratchet attachment on the camera bed which moves the lens forward and back and

serves for fine adjustment in focusing. A combined device includes the diaphragm and shutter movement in most folding cameras and "an adequate adjustment for diaphragm and shutter movement" is one that provides several sizes of openings for lens and at least three shutter movements, namely: fast instantaneous, slow instantaneous and time. Many shutters open for specified durations from seconds to fractions of a second. They permit one to work more accurately than with the durations designated merely as fast instantaneous, slow instantaneous and time. Any of the bulb actuated shutters put on folding cameras is satisfactory provided it embraces the points mentioned as adequate.

A camera like that described as a serviceable one will do for first-class work. However, there are more complete adjustments for those who wish all that a camera can offer in that way. Beside the vertical back swing, there may also be an horizontal back swing which corrects distortions in the horizontal plane. It is well to have one, but not so frequently necessary as the vertical swing. An extra long bellows or a bellows extending both forward and backward, is a feature in some cameras. It enables one, in copying, to reproduce an original in the same size or even enlarged, and permits the use of a long focus lens, which gives a larger image of a distant object than would otherwise be possible. A lens convertible into long and short focus is usually sold with cameras of this description, the short focus having its advantage in copying and interior work, and the long

focus in distance work. One more item completes the list of adjustments. It is a reversible back, whereby a picture may be taken either crosswise or up and down a plate. This adjustment increases the bulk of a camera, because it must have a square inside measurement of the longest edge of the plate. In addition, lenses may be substituted by better and higher priced ones, or, several lenses of different focal lengths may be had for the camera. To sum up, the most complete thing in a folding camera that the market can offer is one having an adjustment for film attachment, a rising and falling front, rack and pinion, double back swing, double extension bellows, reversible back and convertible lens. The Double Extension Reversible Premo presents this equipment.

From the endless variety of folding cameras, the simplest way to get at a selection is this:

1.—If you can afford to get whatever you please, choose according to purpose.

a. In case you must have one to do copying, outdoor work, indoor work, enlarging, everything that can be asked of a camera, get one having all described in the complete folding camera.

b. In case you want one to do general amateur work and do it well, get one like those described as “serviceable for first-class work,” or, if you wish, one having both swings.

2.—If you cannot afford to get a medium price camera, get a camera with the vertical back swing but without rack and pinion. See Poco C or Premo B. At still less price get one without either swing or rack

and pinion, though without these, a folding camera has doubtful advantage, if any, over a magazine camera.

**A Complete
Outfit.**

A beginner should remember that a camera falls far short of being an outfit. See last chapter for list of things necessary to an outfit.

**Loading
Film Cameras.** The method of loading film cameras varies somewhat with the camera, but the general principle of loading is as follows: At either end of the camera box is a reel and the film is reeled from one to the other as it is exposed. A flat space between the reels places that portion of the film in position for exposure, and each successive portion of film is reeled into this position as exposures are made. The reels fit into sockets and that one upon which exposed film is turned is actuated by a thumb screw on the outside, whose stem extends through the reel. Every new roll of film then is placed at the end away from this thumb screw, the old reel being thrown out and the black paper covering new one pulled over to thumb screw reel, through which it is caught by a tin or slit and turned a few winds to bind the catch. After closing the box, the screw is turned until figure 1 appears under a red glass at the back end. This indicates proper placement of film for the first exposure—expose, turn to figure 2 for second exposure, etc.

**To Load
Plate Holders.**

To load plate holders, inspect your holders by daylight and practice loading with a cardboard cut to the proper size.

Plates are put in holders in the dark room by ruby light only. Dust the film side of each plate with a camel's hair brush, placing it film up in the holder. The film side is dull and will stick to your tongue. Test at the very edge.

**The Dark
Room.**

A dark room for photographic purposes should be perfectly light tight. All leaks from door casings and cracks should be stopped up. Description of dark room in last chapter.

**Ruby
Lanterns.**

The small ruby lanterns sold by stock dealers answer the purpose after a fashion, but are generally unsatisfactory. One had better substitute a window ruby or enclosed light such as described in last chapter.

Exposing.

Exposing is taking the picture. Its accuracy modifies all later work and requires the practice of careful judgment.

**Exposing
Directions.**

Number your holders on each side, the first holder 1 and 2, the second holder 3 and 4, and so on. Always expose in the order of numbers and thereby prevent endless confusion as well as preserve data for developing. A tripod can be dispensed with for instantaneous exposures even to one-fifth second, but care must be taken to hold the camera perfectly still. Movement of camera during exposure gives a picture a blurred appearance and double outlines. Always use a tripod for exposures longer than one-fifth second, and it is better to do so with even that exposure. Never point camera in such a direction that sun shines on the lens. If

the sun is at one side and just glances into it, the lens may be shielded with a hat or slide, with care however, not to shut off part of the view. For all focusing not done with a finder one should be provided with a head cloth. The finder is a small lens and mirror which reflect upon a piece of ground glass fastened in the box of hand cameras and on a small block in folding cameras. It shows what view is included with different positions of the camera.

1. TO EXPOSE WITH A HAND CAMERA—FILM.

a. Set diaphragm for opening and shutter for exposure wanted.

b. If not in place, reel out film to figure 1.

c. Point camera toward view and observing the finder, change direction of camera till view desired is imaged there. Tip the camera to include more or less of sky, as desired, and level it so that upright objects appear upright. This last is important. Failure to get true lines gives everything a toppling over appearance.

d. Expose by pressing button.

e. Reel film to next number. Make it a habit to do this immediately after each exposure. Then, should the shutter be accidentally opened, a picture would not be spoiled.

2. TO EXPOSE WITH A HAND CAMERA—PLATES.

a. Set diaphragm and shutter.

b. Put plate in position, if not already so.

c. Point and level camera. (See *c* preceding exposure directions).

d. Uncover plate or pull slide.

e. Expose and cover plate.

The only difference between film exposing with a hand camera and a folding camera is in the use of a focusing scale. The hand camera, having fixed focus is simply leveled and exposed. A folding camera must be pulled out to the figure on focusing scale which represents the distance in feet from camera to view. When the exposure is to be on a person or particular object, set focusing point for the exact distance of that person or object. But if a view of an object covering some distance is to be made, the focusing point should be set for about one-third the distance from camera to end of view, or, considering a view as made up of foreground, middleground and background, extend the bellows for the distance between the foreground and middleground.

3. TO EXPOSE WITH A FOLDING CAMERA—FILM.

a. Pull out bellows to distance on scale.

b. If not in place, roll film to exposure number.

c. Set diaphragm and shutter, and push over shutter guard.

d. Point and level camera.

e. Press bulb to expose.

f. Reel film into place. See *c* under film exposing with hand cameras.

4. TO EXPOSE WITH A FOLDING CAMERA—PLATES—
USING FINDER.

a. Pull bellows to scale distance.

b. Set diaphragm and shutter and push over shutter guard.

- c.* Insert plate holder and pull slide.
- d.* Point and level camera and expose.
- 5. TO EXPOSE WITH A FOLDING CAMERA—PLATES,
BY FOCUSING.

- a.* Open and set camera in position.
- b.* Set diaphragm and open shutter.
- c.* Watch the ground glass at back end of camera and rack out the bellows till objects appear sharply defined on it. (Look *on* the ground glass, not through it.) A cloth thrown over the head enables one to see image clearly.

- d.* Close and set shutter for desired length of exposure and push over shutter guard.

- e.* Pull slide, shielding holder from strong light.

- f.* Expose and replace slide. Hold slide in line with holder as you replace it and shield holder while replacing.

Developing. Developing is making a picture visible on a plate after exposure. It is done in the dark room by ruby light.

Developer. Developer is the solution used for developing. Of the many varieties on the market, a combination of metol and hydrochinon leads for amateur use. It does not stain hands, gives good results and is adapted to a wide range of work. In buying developer, do not get that in solution. It is apt to have been made up so long as to have partially spoiled. Get the powders and solute them as you have need. Or, if you prefer to make

your own, buy as directed in the list of necessities for developing (last chapter), and a mixture according to the following formula will do well for general work.

SOLUTION I.

Formula for Developer.	Water	30 oz., or 900 cc.
	Sod. Sulphite crys .	6 dr., or 23 gms.
	Metol	1½ dr., or 6 gms.
	Hydrochinon	1 dr., or 4 gms.

Mix cold and bring just to a boil, then filter into two 16 oz. bottles and keep well stoppered.

SOLUTION II.

Water	10 oz., or 300 cc.
Pot. Carbonate	1 oz., or 30 gms.

TO USE.

Take 6 parts of I.

“ 1 part of II.

“ 2 parts of water.

Solution I keeps well if not exposed to air. By stocking in two bottles, one portion is kept entirely from air, and both bottles being small, the air chamber left as solution is used will not amount to much. Set one bottle aside until the first is empty. Spoiling of developer is indicated by its turning dark. A slightly darkened developer can be used for only fully exposed plates and a decidedly darkened developer (brown to brown black) is too far gone for use.

Some people find that metol irritates the skin, even to making it break out with sores. But these cases are the exception. Anyone affected by it can resort to rubber gloves or use another developer. Of the

developers one might use to replace metol, eikonogen is recommended because it can come under the rules for developing which are mapped out. It can also be used for as many purposes as metol. But pyro, beside staining hands and being incapable of use for as many purposes, requires modified instructions which are left to the review chapter where preceding instructions will make those modifications intelligible to the reader. Those who find it necessary then can substitute eikonogen for metol in the formula already given, making no other changes. Follow subsequent instructions as if using metol, but bear in mind that eikonogen-hydrochinon works slower than metol-hydrochinon.

Fixing. Fixing follows developing. It consists in clearing out of a plate whatever material has not been used in the process of exposing and developing which, if left, would only obliterate the image and destroy it in time.

The Fixing Bath. The fixing bath is made of three or four parts of water to one part of hypo. Or, simply throw a quantity of hypo into a two-quart Mason jar and fill up with water, letting all dissolve that will. If crystals all dissolve, put in more hypo. Always keep the bath in this jar and pour it out into the hypo dish before developing. Hypo should be kept away from everything else and fingers should be washed from it before handling anything else.

CHAPTER II.

**Preface
to
Exercises.**

This and three succeeding chapters include exercises for the benefit of those who wish practice work. The present exercise is in the form of detailed directions which may serve to initiate one into the routine of dark room work as well as explain the various steps taken. Those who prefer to read rather than practice can do so without more loss than the appreciation of deductions which execution ought always bring. But the value of these chapters to old workers would be increased by the practice and new workers will save time and expense by doing the actual work. As a systematic course, it is recommended that one follow the chapters in this order: First, I–VI inclusive; next, chapter X; then, after reading chapters VII–IX, finish the book. Read through the discussion of each subject before doing the exercise recommended. The first six chapters are a foundation to all the rest and it is advisable to get them thoroughly in mind before passing to the work on prints. It behooves one following these instructions to do so in every particular, for a little change to suit one's convenience will often defeat the very purpose of the directions. It may be best, whether one has had experience or not, to follow the rules for exposing that

fit his case. Usually, a great deal of time is needlessly lost for lack of system in exposing and, as quick work is important in most exposing, a systematic habit will insure that thorough quickness which haste cannot.

To mention preliminary facts and gather the method of treatment, let it be stated that a photographic plate is a coated glass which has finely divided particles distributed throughout the coating. Also that these particles are affected or changed into a different substance by the action of light so that when developer is applied to the plate they darken and all particles not darkened by light plus developer are then cleared away in a fixing bath. When a plate is exposed through a lens, light reaches it in the form of an image and the darkening occurs in the form of that image. If then, only exposed particles are ever darkened by developer, a fixed plate would always present an unobstructed image upon a clear glass support; but if other particles are darkened, the image would be obscured to the extent of their darkening.

It is obviously best to secure as clear an image as possible. The first query taken up in the subject of developing is, therefore: Does developer darken exposed emulsion alone or both exposed and unexposed? And following it, Does blackness develop in ratio of exposure? What means are there for determining whether an exposure be short, medium, or long? How does an exposure develop and when is one developed?

EXERCISE I. *Routine of Work in Developing. Inquiry into the facts of developing.*

Required. Camera, developer, one developing tray large enough to hold two plates, hypo and hypo dish, one box of ordinary photographic plates and one box of lantern slide plates (Carbutt's or Seed's).

The Work. Make three consecutive exposures on the same view according to the following directions. On a bright day, an open view, as field or street scene.

HAND CAMERA.

1. Smallest diaphragm—fast instantaneous.
 2. Largest diaphragm—slow instantaneous.
- (In fall and winter, smallest diaphragm, shortest possible time exposure.)
3. Largest diaphragm—short time exposure, one or two seconds.

FOLDING CAMERA.

1. Diaphragm 32—Shortest possible exposure.
2. Diaphragm 32—1-5 second or slow instantaneous. (On a bright summer day, 1-25 second.)
3. Diaphragm 32—2 seconds or short bulb exposure.

The purpose of these directions is to get one plate under-exposed, another correctly exposed and a third over-exposed. The directions will present those conditions as nearly as possible when general directions must apply to individual cameras and surroundings.

With exposures made, proceed to developing.

Avoid a hot or extremely cold room. Have fixing bath ready so that plates can be put into it immediately from developer. Dissolve enough developer powder to make an eight ounce solution and leave it bottled. Or, mix eight ounces for use from the stock solutions recommended on page 18 and bottle for use by portions as directed in the course of this exercise. Have developing tray large enough to hold two plates. Close the dark room and taking one unexposed plate out of box, hold it to open light for a few seconds. Closing room again, place this plate in the developing tray with an unexposed plate fresh from the box. Flow them with three ounces of the ready mixed developer, keeping tray in gentle motion so that the solution will entirely cover plates. Now look for four things:

1. That the exposed plate turns dark.
2. That the unexposed plate remains unchanged for a time.
3. That the exposed plate gets intensely dark as developing proceeds.
4. That the unexposed plate clouds over after a few minutes, turns dark but not black like the other.

When you have seen these four things distinctly, rinse the plates in water and pass them to the fixing bath. Do not let fingers touch developer while they have hypo on them. Rinse them from hypo, pour developer into a spare bottle and rinse tray.

The points to get from this work are that developer produces an effect upon both exposed and unexposed plates; that its effect upon an exposed plate

is quick and pronounced, a turning to black, while its effect upon an unexposed plate is slow and not so pronounced, a turning to grey.

Proceed next to developing the camera exposures. Take exposures 1 and 3 out of holders and mark their respective numbers on the coating of each plate near edge. This is for later reference. Keep in mind which is which and develop them in the same tray, using another three ounce portion of the ready mixed developer. (If developer does not cover the entire plate when first flowed, its path will develop a decided streak, dark where it covered and light where it did not.) Notice first that a more or less complete image develops on both plates, and second that, barring the image, their appearance and behavior correspond to the plates already developed, the long exposure developing fast and dark, the short exposure slowly and not so dark. Lift them out of the developer occasionally to examine by looking through the plate; but only momentarily. Put them directly back into developer. Notice, furthermore, that the long exposure gets so dark as to almost or entirely hide the image which appeared at first. The short exposure, on the other hand, if short enough to answer its purpose, seems to come to a standstill, remaining faint and (likely) the view is not fully imaged in shadows. Watch these shadows, the lighter portions, very closely, observing that after a few minutes they cloud or mist over in somewhat the manner of the unexposed plate and that, as this mistiness increases, the image becomes less distinct.

When these points have been observed, perhaps in ten minutes, rinse and pass the plates to hypo. This rinse is merely to wash off developer so that it may not stain the fixing bath. Pour developer into the spare bottle with that used before and rinse tray.

About Fixing and the Fixing Bath. Turn on the light and, lifting these last plates from the hypo bath for a moment, notice the white appearance which shows at their backs. In a few minutes lift again and see that the white is clearing away. The hypo bath is used for this clearing, and the substance cleared away is the material in plate coating which was not blackened by light and developer. If left, it would be injurious to the permanency of a negative and obscure the image. When a plate is entirely cleared, it is ready for the next step, washing. The time occupied in clearing varies with the amount of unused material left in a plate, but, with average conditions, it should occupy from five to ten minutes. The clearing must be thorough, and one is well advised to leave plates in the fixing bath for a few minutes after all white appearance has disappeared. No harm can result from leaving negatives in this bath for an hour or more, except in very warm weather or when the bath is old and stained. The former circumstance is likely to soften the coating, even to make it frill or wash off the glass. Whenever the coating feels soft and slimy, flow it with a solution of alum (lump alum) for a moment to toughen it. A deeply discolored bath would stain a negative during prolonged immersion. As fixing bath is em-

ployed to clear unused material, so washing serves to dissolve all hypo that has soaked into the coating, for hypo also would lessen the permanency of a negative. Negatives that crystalize on the surface as they dry or turn yellow in places, sometimes crystallizing as well, have not been thoroughly washed from hypo. The yellowness sometimes appears after weeks. Do not risk short washing and then try to discover how the stain may be got rid of; but wash thoroughly. If water alone would clean out unused material, hypo might be dispensed with. But since water will not accomplish the end, the only alternative is that resorted to—a thorough clearing in hypo, followed by a thorough washing. (Directions for washing and drying negative on page 35.)

After fingering in the hypo bath, wash hands thoroughly. Hypo is bad stuff out of its place. Even the traces which fingers will carry from fixing bath to developer would act upon a plate sufficiently to retard development. And in other ways hypo causes much trouble. Make it a habit from the start to rinse hands after they have touched hypo, dry or wet, and to not let the solution drip on shelves or floor.

Upon examination of the cleared negatives by white light, they seem not so dark as when taken out of developer.

Examination of Work.
Loss of Density. Or, as photo-phrase variously puts it, they have less density, are not so intense. And in fact, their appearance is that of less density, for when a plate is examined from developer by ruby light its apparent density is greater than its

real density by the amount of unused material left in the coating, which is like a curtain over the image and when cleared out, leaves a negative seemingly less dense. This loss of density by clearing causes some difficulty in determining when a plate has developed sufficiently. Observe again the difference between the long and short exposures; note the lack of detail or imagery in shadows of underexposure and see whether the cloudy effect (mistiness) was sufficient to show after clearing. Compare also with the two plates first developed.

Developing Appearance of a Correct Exposure.—Comparative Behavior of Under-exposures and Over-exposures in developer.

Before developing the remaining exposure, for which there is the last portion of ready-mixed developer, get in mind the following description of a correct exposure as it appears in developer. When a plate is correctly exposed, it shows darkening in less time than the short exposure just developed, but not so quickly as the long exposure. An image can be seen as the plate lies in the tray and when held up to ruby light. Every part of the view seems fully pictured and there is a steady gain in darkness, the parts preserving their contrast and the image remaining visible whether plate is in or out of tray. Such is a correct exposure. But your medium exposure may not answer this description. Nevertheless, as it was exposed less than one and more than the other of two plates which were respectively overexposed and underexposed, it would reasonably take a ground

somewhere between them. In case then the behavior of this third plate favors that of the underexposure, the conclusion may reasonably be made that if the exposure is wrong either way, it is too short. And, vice versa, if this third plate behaves in manner favoring the overexposure, it may reasonably be pronounced overexposed, if wrong at all. Now the question, is it wrong? The description of a correct exposure abbreviates thus: Appearance, moderately quick; darkening, steady; view, fully detailed; image, visible in and out of tray, slightly less so as developing continues, but still visible. The steady darkening continues for five or six minutes in fresh developer. Compared to this, we find that while an underexposure comes up slower, the main distinction in developing is that it soon comes to a standstill, refusing to darken steadily and remain clear. And while an overexposure darkens more rapidly, its point of distinction is rather that it darkens until the image becomes hidden in black. Mark then, whether the third plate tends to a standstill or toward blackening overmuch. This settled, it is an easy matter to increase or decrease exposure on the same view with like day and light. Do this if your exposure was a little off, and from the finally correct exposure as a standard, experience will bring even results in outdoor exposing by allowing more or less exposure for changes in conditions from those of the standard exposure. For example:—same light, same season, but different subject; vary for subject. If water scene or open prairie, short exposure. If a denser view, more

trees, a building close up, longer exposure. Or, with same season and same class of subject, but darker day, vary for day. Make it a habit also to take a last look at the ground glass before each exposure for the sole purpose of seeing how well it is illuminated. This, in time, will be a great help, because it applies in all localities and at all seasons. Despite all easy rules and methods, proficiency in lines of photographic work must be arrived at by close observation, and these suggestions, as well as many succeeding, are written to give methods which many have had to find by long experience.

Finally, develop the medium exposure by watch in the last portion of ready mixed developer. Let it remain six minutes, noticing whether it answers the description of a correct exposure or favors another.

Inquiry into the penetration of emulsion by light and developer.

By Trial For the last work of the exercise, select
Exposures, a negative of average density and expose two lantern slide plates through it by contact. (Fresh workers will of course be obliged to borrow a negative or forego the work relying upon the conclusions stated.) Place the negative in a frame, film up, as for printing, and placing a slide plate film down in contact with it, fasten frame and expose by holding a lighted match at a distance of six inches for about seven seconds. Put this exposed plate in a box, while exposing the second for the same time. But let the glass side of this second plate come in contact with the negative; that is, the first exposure

to be made in the regular way, film to film, and the second exposure, glass against film of negative. This second exposure will be blurred because of intervening glass, which circumstance will serve to distinguish it from the first. Develop these together with the developer that was used and bottled. Observe the following:—1. That though they were exposed alike, the film to film exposure shows an image more plainly as they lie in the tray. When they have developed a full minute, lift them from tray and compare the appearance of backs; observe, 2, that the case is reversed, the glass to film exposure showing more plainly than the film to film. Now compare by looking through. Probably the film to film exposure will appear somewhat darker on the whole. But, looking again when they have developed several minutes, their densities will have become about equal. Notice backs again and see that the second exposure seems to show about as plainly at the back as does the first exposure at the front. Close observation will also bring out the fact that the first exposure gains contrast by continued development, while the second exposure loses contrast, the lighter portions of the second filling in detail after a minute or more of developing.

Discussion. Without experimenting, it would be natural to suppose that the light sensitive particles in and nearest the exposed surface of an emulsion would be the first affected by light. And if this were true, it would follow that particles more deeply imbedded would be affected in the order of

their depth. The exposures with lantern slide plates seems to demonstrate such a proposition as true. There were two plates, of which the one had its upper surface exposed toward the light and the other, its under surface toward the light for the same length of time. The upper surface exposure developed a stronger image on top, while the other developed a stronger image underneath. The following figures give an illustration of these conditions.

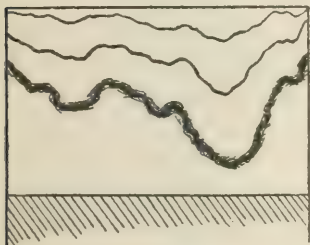


Fig. 1.

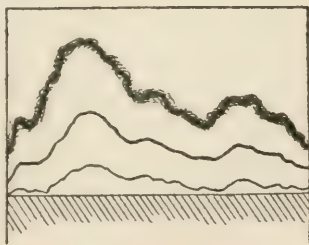


Fig. 2.

Let figure 1 represent a cross section of emulsion highly magnified. According to the demonstration, an image would travel down this emulsion in some such manner as indicated by the successive curves. The light effect or image impression is represented by a curved line rather than a straight one because the exposure on different parts of a plate varies with the amount of light reflected from different portions of the subject. The curves of figure 1 represent the upper surface exposure, and those of figure 2, the lower surface exposure, one having a thickness of emulsion beneath it and the other, a thickness of emulsion

above it which circumstance makes their developed images visible from opposite sides of the plate.

It would be natural again to suppose that developer acts upon exposed particles in the order of their depth. The trial exposures verify this supposition also, for images relatively disposed in an emulsion as those of figures 1 and 2 did not appear at the same moment though exposed alike and developed together. Developer penetrated to an appreciable depth in emulsion of second exposure, corresponding to figure 2, before it could bring up an image, whereas; from the other exposure, developer brought up an image at the start, and although the second exposure finally developed with almost the intensity of the first one, yet it was longer getting to that point. So the experiment establishes a second supposition, that developer acts upon the particles in an emulsion as it penetrates that emulsion.

A third inference and fact comes in consequence of the two mentioned. As varying intensities of light cause varying depths of light product, some parts of an emulsion develop blacker than others. But the comparative intensities of high lights and shadows cannot be fully brought out until developer has penetrated as deep into the emulsion as has the deepest light product. (See figure 2). Consequently, contrast increases as the full image exposure develops. Your attention is called to this fact in exposure 1 of the trials. But in exposure 2, a loss of contrast was noted. In this case, however, exposure started from the bottom of the emulsion and development from

the top surface, and as a result, the last part of exposure, where only high lights had penetrated, developed first, the shadows not filling in until developer had penetrated to their depth. Hence, this plate developed its greatest contrast at the start, confirming thereby the observation that exposures made in the regular way, film toward light, develop with increase of contrast.

The deductions regarding penetration by light and developer will usually be got by one trial of the experiment, but it may be well to make a second trial for the sake of seeing this third and last deduction clearly. These deductions, combined with those from the opening experiment of this exercise, give the key to the relations of exposure and development, and it is advisable, therefore, to get the exercise well in mind. Wash and dry all the negatives of the exercise for reference in later discussion.

The exercise indicates—

In Review

1. That developer produces an effect upon both exposed and unexposed plates.
2. That it causes blackening in an exposed plate.
3. That it develops greyness in an unexposed plate.
4. That its action upon an exposed plate is much quicker than upon an unexposed plate.

How to determine correctness of exposure while plate is in developer (not pyro.)

5. That a long camera exposure develops an image quickly, the black product of exposure plus developer becoming so pronounced as to almost or

entirely hide the image, and that the appearance and behavior of such an exposure corresponds to the appearance and behavior of the plate exposed to open light.

6. That a very short camera exposure develops an image slowly as compared to 5, the product of exposure in this case not being pronounced, seeming rather to flag, while a mistiness obscures the image, and that the general appearance and behavior of this plate corresponds, in a measure, to the unexposed plate of 3.

7. That a medium camera exposure develops with moderate speed, the dark product of exposure plus developer increasing steadily while the image becomes neither hidden nor obscured but retains gradations of tone and imagery in every part, which can be seen at all times during development. And that its general appearance and behavior occupy a middle ground between the long and short exposures. By comparison also with the other exposures, it indicates that the amount of darkening by developer varies with the amount of exposure.

(In regard to fixing.)

8. That the white appearance seen at the back of a plate clears away showing that the fixing bath is a clearing solution, and the consequence of clearing is a loss of density.

9. That the substance cleared away is unused material which would be a detriment to a negative if left. That water will not dissolve out this material, necessitating the use of hypo which must in turn be

washed out or traces will crystalize as negatives dry and turn them yellow in time.

(And from the final experiment.)

10. That light penetrates an emulsion and affects its particles in the order of their distance from the exposed surface.

11. That developer penetrates an emulsion blackening light product as it penetrates.

12. That contrast increases as image development proceeds.

**Washing
and Drying
Negatives.** Swab a negative with clean cotton in passing it from hypo to the wash. Negatives should wash twenty minutes in running water or soak three quarters of an hour in standing water changed several times. When washed, swab negatives again to remove dirt and sediment from the water (not the same cotton which was used to swab off fixer unless it has gone through the wash with negatives) and set them in drying racks sold for the purpose. Dry in a current of air free from dust; but do not partially dry a negative in a warm room and finish in a cold room, or vice versa, because the difference in drying speed would leave a streak. Instead of using racks, negatives can be set cornerwise between two nails driven in a wall. Alcohol is sometimes used to hasten drying. If used, let the bulk of water drip off for a moment and then flow film side with just enough to comfortably run over it. But do not drain alcohol back into bottle. Flow it on to another negative or throw it away.

Film Developing. The directions for film developing had best find space in the beginning exercise, although films are inconvenient for exercise work. Directions usually inform film users to cut each exposure from the roll for development, but it is safer to develop the whole film until the divisions between exposures appear, then cut and manipulate like plates. One cut film can be piled on top of another in a tray, but there should be care to keep edges from scratching or digging into the film beneath. Have plenty of solution and give film a preliminary soaking in water to limp it.

The method of procedure is as follows. Fill one tray with water and another with a generous solution of developer, and have a pair of shears at hand. After removing the roll from camera and closing room, unroll the entire film (twelve exposures), cut it from the paper, and holding by the ends, pass it through the tray of water from end to end and back again, repeating until the whole film is limp. Now pass to the developer and repeat the operation until the divisions appear. Then curl up film in the developer tray and cut every other division at first. Work quickly, immersing each cut and passing film through solution before making another cut. This will insure getting cuts in the right place, but if the work is not done quickly and films kept separated, uneven development results. If there is difficulty in getting even results, the film can be passed to water during cutting and then back to developer or, the method of making all cuts before starting development can be resorted to.

Fix and wash films in a tray and for the same time as plates. After washing, soak the films for one hour in a bath of thirty parts water to one part glycerine and fasten them to a board or wall directly from this bath by driving tacks half way at the corners. Too much glycerine makes them limp and sticky, while with lack of glycerine, they stiffen and curl in drying. In the summer time, they should be well toughened with alum prior to washing. (See bottom of page 25.) Use the same developer as for plates. For film loading and exposing see page 13.

CHAPTER III.

Fog. It is largely true that the rapidity and amount of darkening in developer is a direct index of the amount of exposure a plate has received. But a plate is sometimes unintentionally exposed in other ways than through a lens, so that while the amount of darkening is an index of the amount of exposure in the general sense, it is not always an index of the amount of image exposure. All darkness which develops in a plate from any other source than image exposure is known by the general term fog. It is unfortunate that the mention of fog cannot be set aside for everyone until trained observation would make its distinctions easier. But its discussion comes early because many are unfortunate enough to experience fog at the outset. The term itself is used very indiscriminately and so commonly without distinction as to source that it conveys no definite information. Fogs may be classified as light fog, plate fog, developer fog, and perhaps overtime fog.

Light Fog. Light fog results from light's striking a plate otherwise than through a lens and in the form of a defined image. Its commonest sources are unsafe dark room light, leaky dark room, leaky plate holders, reflection on lens, failure to shield holder, especially when slide is drawn and faulty in-

sertion of slide in holder. Or, classifying these sources, a light fog proceeds from causes in the dark room and causes out of the dark room. Fogs proceeding from causes in a dark room cannot ordinarily be intense, because the room is closed and an unsafe ruby light or faint light from wall leaks affect an emulsion slowly, and as an exposed emulsion develops grey, dark, black, or very black, according to the amount of light which has affected it, a dark room fog is likely to develop only an even filling of grey, which compares very closely with the semi-blackness that can be developed in unexposed emulsion. But light fogs proceeding from causes outside the dark room are ordinarily more intense because a plate is exposed to an open flood of daylight. The source of light fog is usually evidenced by its tracing on a plate. Black streaks and patches near the edge of a plate label themselves as light fog, and are evidently from such sources as faulty insertion of slide. A sun reflection on the lens gives a wide-spread fog or a blotch toward the center, and the suggestion may lead one to recall, for example, that the position of the camera left a chance for sun reflection. (See bottom of page 14.) Locate a fog as nearly as possible from indications, and if the decision lies between two sources, as between dark room and holder, inspect both, and, if necessary, make trial with another plate holder or a different dark room.

Plate Fog. A plate fog finds its source in the condition of emulsion before exposure. This fog distributes itself evenly over a plate and is distin-

guished by an increase of darkness all around the edges. It results when plates have been kept in a damp place or have become dampened some time prior to exposure or development. Old plates, which have lain around for a year or two since manufacture, develop this fog unless they have been kept under most favorable conditions. Moisture aids chemical action, and so, in a plate, the moisture which gathers from ordinarily dry air is instrumental in setting up a condition of emulsion which develops fog. As heat also accelerates chemical action, the hot, moist air of summer months places the usable age of plates at a lower limit than would cool dry air. The spoiling of a plate by these causes amounts in effect to a weak exposure evenly distributed over it, and when developed, compares in appearance with the semi-blackness which can be developed in unexposed emulsion. It is distinguished from an even light fog by the increase at edges.

On the average, plates should be used within six months after manufacture. Slow plates keep better than fast plates. Any fog resulting from manufacture would of course come under the head of plate fog. There are easy chances for producing fog during manufacture, but it seldom happens that a fogged emulsion gets on the market, if made by a leading maker. A worker troubled with fog on a reliable brand of plate had better content himself that the trouble does not lie with the manufacture.

**Developer
Fog.**

The third fog, developer fog, is the effect of developer upon unexposed emulsion. Enough has been said about its occurrence and appearance to understand that it is a haziness which develops when developer has penetrated beneath image exposure. It may also result from an excess of alkali in developer. But that point comes up in the discussion of developers, chapter VI.

**Fog from
Over
Exposure.**

The class uncertainly named overtime fog is not strictly a fog. It is merely the heavy darkening which follows from overexposure and is classed here only because the mention of its similar appearance may prevent one from confounding overtime with fog. Its distinctions from fog appear in the following suggestions.

While developing, it is not so necessary to distinguish between different fogs as to determine readily whether a certain dark appearance is due to fog or to overexposure. When there are no conditions of fog, the rapidity and amount of darkening are sufficient index of the amount of image exposure, and, in cases of underexposure, the degree of underexposure is indicated by the density of image obtained when development has come to a standstill; while, in cases of overexposure, the degree of overexposure is indicated by the rapidity with which the image blackens over and how completely it becomes hidden. But with conditions of fog, an image almost invariably develops weakly and with a muddy appearance. If then a full image develops up fast and darkens over, the

case is one of overexposure, not fog. But if an image does not come up quickly from the start and while it remains faint or seems not to have shown at all, there comes a decided darkening, the case is one of fog. And whether it be light fog or plate fog makes no difference with developing treatment. The rarer case of overexposed image and additional fog would, of course, develop fully detailed shadows if any distinguishable image could remain after such a double dose of dark product. One should continue development in cases of fog until he feels certain that all image exposure has been developed; for the fullest possible strength will best outline an image against fog. But to continue beyond full image development would only add fog.

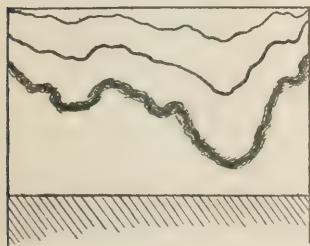
Determining Exposures after Development. Compare the negatives of exercise 1, and see again that the medium exposure takes a middle ground between the others. Observe, also, a difference in the shadows of the three exposures, that the negative with least exposure lacks imagery there while the shadows of the overexposure are fully detailed (pictured) and the medium exposure, if correct, shows full detail throughout both lights and shadows. But if it lack detail in the shadows, the lack is an indication of underexposure. *In a fixed negative then the correctness of exposure is determined by reference to shadows.* If they lack imagery—underexposure. If they are fully detailed and other portions also seem well pictured—correct exposure. If they are fully detailed, but remaining portions seem indistinct, and the whole ap-

pearance of the negative is flat, lacking normal contrast,—overexposure. The presence or absence of detail is easier settled after fixing than during development, but an evident lack of it during development would label a negative as undertimed without reference to the mistiness arising from the continued development of such an exposure.

**Reasons
Governing
Rules for
Developing.**

The aim in developing should be to secure an image as clear and fully detailed as the conditions of exposure make possible, and which shall, in addition, have sufficient strength for printing purposes.

A rule for developing would therefore involve the questions:—How is strength obtained? When is detail developed? How can clearness be preserved? By reference to figure 3, in which the curves represent the relative penetrations of an image with different lengths of exposure, it is evident that the successive



exposures would develop with increased density. Density then can be obtained according to the amount of exposure product, but to bring out an image in the full strength and contrast of its exposure, it would be necessary to continue de-

Fig 3.

velopment to the full depth of that exposure.

From the curve representing medium exposure, it appears that there is exposure product for every part of the view and that even in the curve above it, there

is also delineation for all parts of the view, but because of its nearness to the surface, there could be little chance for developing strength. From this it would seem that a short exposure may be sufficient to develop detail but not printing strength. Now it does not follow that all the detail possible to an exposure develops before all the strength possible to that exposure develops. But as a matter of experience, it is a fact that such developers as metol, hydrochinon and eikonogen do develop detail first and strength afterward. Often a slight underexposure presents a detailed image with lack of strength and oftener, too, a negative which had sufficient exposure to develop printing strength but was not developed enough, proves to be fully detailed though weak. The development of detail then takes place during the early stage of darkening.

Clearness is preserved by avoiding developer fog and by clearing away extra density in cases of over development. It is obvious that any development of a plate deeper than its exposure cannot add to its image but will, on the other hand, destroy clearness.

**Rule for
Developing
Under
Exposures.**

So the *rule for developing an underexposure is to watch its shadows and as long as they remain clear, continue.* But the moment any muddy effect appears, development should cease. There are degrees of underexposure but the same rule applies to all. The observed difference in their developing is that plates but little underexposed do not show evidence of it until they have been in developer for some time. They

develop in full detail but fail to gain sufficient density. A plate which has every part of a view imaged even faintly can be intensified to printing strength after it is fixed and washed. (Directions for intensifying at end of chapter.) But a plate which fails to develop even detail is good for nothing as a negative. It would not be helped by intensification because there is but a partial image to strengthen. A plate with longer exposure, however, could develop strength besides detail, and would with longer development, showing that the amount of developing which plates should receive varies with their exposures.

**Rule for
Developing
Overexpos-
ures.**

By reference to figure 4, which represents the relative penetration of images in under and overexposures, it appears that developer would produce but little dark deposit when it developed to the depth of the upper curve, but would blacken much emulsion by the time it reached the depth of image represented by the lower curve and, by the time it penetrated to that depth, the full contrast of this exposure would be developed but be buried beneath a heavy coating of black.

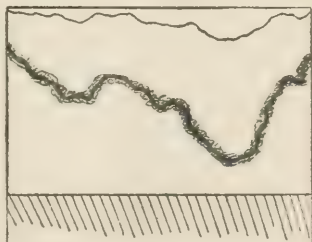


Fig. 4.

As an exposure continues, high lights undoubtedly penetrate at a faster rate than the shadows but as far as the shadow exposure goes, it produces the same effect as the high light exposure, and thus

there is an even layer of exposure product as far down as the shadow penetration, which simply adds density to the negative when developed. But below this depth, the varying depth of exposure brings out the gradations of light and shadow. The top development of an overexposure then is density, not image, and an image can only be brought out in its full strength when development has proceeded to the depth of exposure. It would therefore be wrong to develop an overexposed plate merely until it seems dark enough, for likely there would be plenty of darkness at that stage but little or no image. *Neglecting then the blackness of an overexposed plate, develop for the image which is toward the bottom of the emulsion.* This often carries development so far that an image cannot be seen for blackness. In such case, there is extreme overexposure and development is stopped only when the appearance at back of plate shows that the emulsion is nearly all developed, not entirely developed but nearly so, because the object is to develop the high lights clear through and leave the shadows as little developed as possible. Sometimes, however, an overexposed plate is not so badly overexposed but that its image can be discerned in the ordinary way. Development is then judged by the rule for developing correctly exposed plates allowing extra blackening according to the amount of extra exposure. For example, if the overexposure is thought to be slight, a shade deeper development than for correct exposure will suffice. Favor overdevelopment in all cases of overexposure, or results will

show a generally dark plate but a weak image. After fixing, the excess of dark product which lies over an image can be cleared away by reducing. This leaves a more transparent plate and still vigorous image. (See end of exercise for reducing, and next chapter for developing correct exposures.)

EXERCISE II. *Development of over and underexposures according to rule.*

Required. Camera, ordinary plates, developer and developing tray.

With these directions, it becomes a part of the exercise to make again the exposures of exercise I in modified form and to develop the over and underexposures according to the rules laid down. One will have determined by the former developing whether the medium exposure was correct. If it was not, modify it to get a correct exposure, and instead of making the other exposures so widely different, make one a little less and the other a little more than the corrected medium exposure. For example, if 32 diaphragm 1-5 second gave a good negative, make that the medium for these exposures and have the others 1-25 second and 1-2 second respectively with the same diaphragm and on as bright a day as before.

Mix four ounces of developer. Develop the medium exposure in this fresh developer for five or six minutes and afterward, develop the other two in the same developer according to rules given. Keep the negatives for work in the next exercise.

For thin detailed negatives.

Intensifier.

1. Water (hot), 3 oz. or 90 cc; mercuric chloride, 30 grains or 2 grams.

1a. Water, 1 oz. or 30 cc; pot. iodide, 75 grains or 5 grams.

1b. Water, 1 oz. or 30 cc; hypo, 65 grains or 4 grams (full).

When 1 is dissolved, pour it into 1a and then pour 1b into 1 plus 1a. Do all pouring by littles with constant shaking of bottle. The liquid will turn red and back again to a slightly yellow fluid. A slight sediment may be disregarded.

Freshly developed negatives require thorough washing from hypo before they can be intensified and dry negatives should have a previous five minutes soak lest they intensify unevenly. To intensify, flow the negative with the intensifier and watch progress of intensification. The usual tendency is to overintensify and the result is a hard printing negative. To note the effect of intensifier and get an accurate idea of how much strengthening is necessary, print a proof from a few negatives before and after intensifying. Compare, on the one hand, for soft and hard effects, and on the other, for the differences in clearness before and after. Some negatives will of course, require more intensifying than others, but as a rough guide, the time occupied should average from one to three minutes in a fresh solution. Negatives should wash for fifteen minutes after being intensified.

Intensifiers build up an image by precipitating a metal upon it in a darkened form. Mercury is the

metal deposited in this case. By itself, it would deposit as a white substance. Pot. iodide and hypo are therefore used to darken the deposit.

For overdense negatives.

Reducer.

Bottle 1. Hypo, a saturated solution.

Bottle 2. Pot. ferricyanide (red)—
a saturated solution. (This bottle should be red or covered with dark paper.)

To reduce.—

Take two parts of 1 . . . $\frac{1}{2}$ oz. or 15 cc.

Take one part of 2 . . . $\frac{1}{4}$ oz. or 7 cc.

Dilute to a 3 oz. solution.

When mixed for use, reducer spoils in a short time. The two solutions should therefore be mixed together only as needed and used immediately. Negatives may be reduced directly from the fixing bath, but if already dry, should have a previous five minute's soak in water. Reduce by flowing plate as in developing. Watch reduction closely. If reducer works slowly, add pot. ferricyanide. If too fast, dilute. Local reduction is accomplished by applying reducer to intense parts with a tuft of cotton. Wash plates frequently during local reduction and do not apply cotton too long in one place. Wash plates thoroughly after reducing same as after fixing. Until one has become accustomed to handling reducer, it is advisable to make a trial on one or two discarded negatives.

The image deposit on a plate is reduced by pot. ferricyanide to a substance which is soluble in hypo but not in water alone. Unless there is sufficient

hypo, therefore, the product of reduction will not wash out, and if left, would injure the permanency of a negative. To be sure then of complete clearing, dip negative in the fixing bath for a minute after reducing. Pot. ferricyanide does not keep well in solution, especially in the presence of light. If it fails to work well after being in solution for say a couple of months, dissolve fresh crystals. Keep only a small solution.

CHAPTER IV.

**How to
Develop a
Correct
Exposure.**

A correct exposure is one which is sufficient to develop a clear and detailed image to printing strength. Since detail develops before strength, the manner of determining when a correctly exposed plate should leave the developer is by observing its intensity or blackness with the purpose of developing until the intensity necessary to produce clear prints has been reached. And the only way to get an idea of this necessary blackness is by printing negatives already made, observing which give the clearest prints. (Print only proofs.) Underexposed and underdeveloped negatives make muddy proofs. Overexposed negatives print slowly and with lack of contrast.

Select a few negatives which seem to detail lights and shadows clearly, and proof them on a gloss paper, such as Lithium or Solio. Print them to the average depth of finished pictures, and compare. Those negatives which print clear and detailed proofs are correctly exposed and have been developed to printing strength. One should observe the density of these negatives very closely in order to determine when another plate has reached that density in the developer.

A negative can also be taken into the dark room for comparison while developing.

**Rule for
Developing a
Correct
Exposure.** *A correct exposure should be developed until it has reached the density of a good printing negative and then let go two shades darker to allow for clearing in hypo.*

A person should fix in mind that there is only one thing to do, namely, to determine when the developing plate is as dark as a good printing negative. That settled, let it go a couple of shades darker. Do not generalize the question by thinking, is the negative dark enough, or is it done? but keep to the definite question, is it as dark as a clear printing negative. Compare, as developing proceeds, with the negative brought in for that purpose.

Some will object to the uncertainty of calculating two shades from this point. The term is only a convenient suggestion of an amount which cannot be better measured in words. If the two shades allowed prove not to have been enough, one is not therefore thrown back to guesswork, but, developing a second plate until it is as dark as a good printing negative, one can allow thereafter slightly more for clearing than on the first trial. A few accurate developings according to the rules thus far recommended will get one in touch with methods which give a definite basis for judgment in place of the guess work which developing so often means to camera workers.

The work up to this point should give a close idea of what is the correct exposure for the two classes of subjects included. For the practice work in devel-

oping, make two such exposures, one on an open view, as in the first exercise, and the other on a building, as in the second exercise. With exposures made, mix afresh four ounces of developer, and divide it into two portions, so that plates can be developed separately and in like developer. Do not time development, but work according to rule given. Develop one of the exposures, and compare it with the sample negative after fixing before starting development of the second exposure. Negatives always appear slightly weaker when wet than when dry. A little leaning that way would therefore be permissible in the wet negative when compared with the dry one. Of course, a correct exposure which happens to be a little over or underdeveloped can be reduced or intensified.

Restrainers. *Temperature in Developing.* A restrainer, in the photographic sense, is some means of retarding the action of developer without totally destroying that action. It may affect an entire emulsion or only parts of it. Restrainers are of two classes, physical and chemical. The former finds illustration in an emulsion that has been toughened or hardened by some means so that it is slowly penetrated by a solution. The gelatine body of plate emulsion is somewhat soluble in cold water. If, then, a photographic plate at a normal temperature be put into ice cold developer, there is a tendency toward hardening the film which retards penetration by developer, and hence retards developing. At a normal temperature, the consistency of gelatine restrains developer enough to

bring about steadily progressive rather than spontaneous action, and under this state of restraint, developer has a tendency to effect first and most those parts wherein is the greater share of light product, for they are the parts most susceptible to its action. Under this normal restraint, then, the action of developer becomes selective, developing a clear image which, except in prolonged development, is not obscured by the developing of unexposed emulsion. But the strength of a developer is suited to the conditions under which it is ordinarily used, as on gelatine emulsion at a normal temperature. So that a developer which will not readily affect unexposed emulsion against the restraint of its normal consistency, may easily affect it when that restraint is removed. In a warm solution, then, the necessary restraining action of gelatine emulsion is removed, selective action ceases, the activity of developer is increased by the acceleration which heat usually gives to chemical action, exposed and unexposed emulsion are affected almost indiscriminately, and there results a hazy, confused development, which confounds any intelligent manipulation. On the other hand, against an emulsion whose restraining power has been increased by cold, developer may even fail to fully affect exposed emulsion. So there is reason for the fact that cold developer works not only slowly, but fails also of developing as fully exposed an image as would have developed in a warmer solution.

The consideration of physical restrainers resolves itself into a study of the effect of temperature on devel-

opment. It shows how intimately associated are exposure and development, and particularly, how carefully the matter of temperature should be considered. The points on temperature are not brought out to emphasize the use of cold or warm solutions as a means of controlling results in developing, but rather to urge the necessity of avoiding abnormal temperatures. While a cold developer does have a retarding effect, it nevertheless preserves perfect clearness. A warm solution, on the contrary, has a decided tendency toward muddiness, so that, of the two extremes, a cold temperature should be favored. 60-70 F. may be taken for the latitude of normal temperature.

Chemical Restrainers. Remembering that the condition of a partially developed overexposure is a lack of contrast, one can appreciate the fact that if a restrainer could be applied to shadows without retarding the development of high lights, at least in any marked degree, there would be a gain in contrast. This, in a measure, is just what happens when chemical restrainers are used. As a physical restrainer presents a condition of emulsion which physically retards penetration by a developer, so a chemical restrainer sets up a condition of emulsion or of the particles within an emulsion which restrains the action of developer. There are, in an exposed plate, exposed and unexposed particles, and of the latter, there is much among the shadows but very little among the high lights. The chemical restrainers, of which pot. bromide is the one commonly used, affect a condition of unexposed particles which is

scarcely susceptible to the action of the average strength developer. Consequently, as the greater share of unexposed emulsion is in the shadows, there is much restraining action there, but not much in the high lights. Shadows then are held back, while high lights proceed, thus developing contrast.

Observe that if a strong contrasty negative were desired, a little pot. bromide would aid in point of contrast, but that the exposure should be full to give opportunity for developing decided strength in the presence of a restrainer.

**Old
Developer.**

Old developer enters into every day practice as a restrainer. In a strict sense, it is not a restrainer, but rather has lost the energy that would enable it to do more with the conditions it meets, and a few trials would convince one that its action becomes less and less energetic until the power to bring up an image is gone. Its slow action is helpful for selective development, if there is sufficient energy to follow up the advantage. For a full exposure, a partially used developer, or part old plus part new, developer is advantageous and gives excellent results, because while old developer tones down the vigor of fresh developer yet the presence of fresh developer insures development. But when a developer's energy is so far gone that it becomes scarcely more than an inert solution over the plate, there is no chance for developing a vigorous image. Instead, a weak image develops along with a general darkening because the presence of a solution rather than that of developer softens the emulsion and

slowly produces fog. The action of old developer is slow, as in the case of cold developer, but, in direct opposition to the tendency of that developer, it gives results showing lack of vigor.

**How to Use
Old Developer
and
Restrainer.** One undisputed fact of developing holds that short exposures require fresh developer. A half used developer must not be used for anything but a full exposure, and not then if it has been kept several days, even when stoppered. It might do, but all successful work, especially in a line which involves so much apparent mystery as Photography, is done on the line of certainties. A saving of one cent in developer has often lost ten cents in plates, beside much time and patience. It is well to keep a two or three ounce bottle filled with old developer. But those who develop only occasionally had better depend upon pot. bromide for restraining purposes, not using old developer except in extreme cases of overexposure, and then in combination with new developer plus bromide. Even fresh developer, when mixed in one solution ready for use, slowly loses strength, especially if exposed to air. A partially used developer therefore, would not long be of service.

With this caution to occasional workers, the following recommendations are made: Partly old developer is advantageous for full exposures. A slightly overexposed plate may require the addition of restrainer, about two drops of a ten per cent. solution to the ounce of developer. And a much overexposed plate would best be flowed with half new and half old

developer, plus a double quantity of bromide. An overexposed plate has much exposed emulsion and comparatively little unexposed. Such an excess of exposed particles so easily susceptible of development should be treated with a subdued developer. Some old developer is therefore necessary; but it would not do to use entirely old developer lest developing cease too soon; for which reason fresh developer is also used, and by the addition of pot. bromide, there is the double advantage of restrainer in emulsion and subdued developer.

For overexposed plates.—

Formula for	Water	5 oz. or 150 cc.
Restrainer	Pot. bromide . . .	$\frac{1}{2}$ oz. or 15 gms.

This makes a 10 per cent. solution which is the strength commonly used. Make a dropper by running a small quill or piece of capillary tubing through a cork stopper.

EXERCISE III. *On restrainers.*

Required. Negatives, lantern slide plates, ice, pot. bromide, developer.

1. Expose two lantern slide plates by contact. (See page 29.) Expose alike and develop one in warm developer—say 80 degrees F., and the other in ice cold developer. The latter can be done by setting a bottle of developer in ice water for a few minutes and afterward pouring the ice water into a large tray in which sets the smaller tray used for developing. Start the cold development first and develop the other exposure while it proceeds. Observe the slow but clear

development in cold solution and fast muddy development in warm solution.

2. Expose two more alike and develop one in developer at normal temperature, the other in developer with two drops of bromide to the ounce of solution, same temperature. A third plate with the same exposure may be developed in old developer. In all cases but that of the purposely old developer, use fresh.

Restrainer as Related to Rules for Developing. The use of restrainer does not vary the rules for developing. Those rules are applied according to the developing appearance of plates, and as restrainers plainly alter appearances in just the proportion that they work, the rules still apply. If an exposure has been shortened in effect by means of restrainer, its appearance indicates the fact and the length of development then hinges upon that appearance.

Developing as Related to Exposure. Developing is, in a sense, a continuation of exposure. A balance must always be adjusted between exposure and developer. But it is not true that developer does the work of exposure or any part of it. The work begun by a short exposure is small and so developer continues only to small results. But with additional exposure, developer has greater latitude. It can do little or much; a negative can be left thin or dense; its contrast may be developed little or much; the same exposure may be made shorter or longer in effect. And thus it appears that the practice of full

exposing is advisable, for there is not only opportunity to control results but, in addition, a moderately long exposure insures a more or less vigorous image, while a badly underexposed plate does not. Let the chances of judgment always favor overexposure.

**Latitude in
Plates.**

The possibility of modifying results permits a latitude in exposure. And because negatives need sometimes be moderately thin and at other times dense, there must be a latitude in the possible density of plates. The figures illustrate magnified cross sections of emulsion, of which figure 5 represents what may be termed a one layer emulsion, and figures 6 and 7, emulsions of two and three layers.

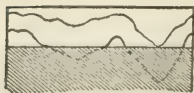


Fig. 5.

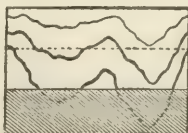


Fig. 6.

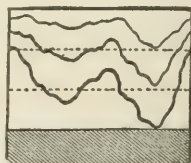


Fig. 7.

It is evident that if one layer could develop but a faint darkening, a whole emulsion made up of one of these layers could develop only a faint image, and if exposure were carried so far that both high lights and shadows penetrated through the emulsion, there could be no image developed. The continuous line of figure 5 represents the most image exposure possible to that emulsion. The dotted lines show

how both high lights and shadows would penetrate through the emulsion with longer exposure leaving the possibility of developing only an even film of black. Fig. 6 represents an emulsion of two layers in which an exposure corresponding to the dotted line exposure of Fig. 5 would both develop an image and a denser image than the continuous line exposure of Fig. 5. Supposing this curve to represent the penetration of exposure necessary for developing a negative of average density, it is evident that an overexposure, as represented by the dotted curve of Fig. 6, could not develop an image. A plate corresponding to the two layer emulsion would therefore develop a good negative when correctly exposed. But a plate with emulsion corresponding to the three layer emulsion of Fig. 7 could be exposed for average density or extra density as desired and if overexposed, would nevertheless develop an image in full contrast. It therefore has latitude, and any plate, to be serviceable, should have that quality. The point is brought out only to suggest one of the possible differences in plates and to emphasize the likelihood of weak results from cheap plates. There are other differences. One brand of plate may work with less speed than another, making it necessary to adapt the length of exposure to the plate used. Some plates also clear out more than others in hypo, necessitating adaptation of development to plate. It is therefore important that every worker use, as far as possible, but one brand of plates and a good plate at that.

It must not be supposed that an emulsion is built up in layers. The term is used for convenience of illustration.

CHAPTER V.

**Getting
Lines True,**

After one can determine the stage of an exposure and the treatment necessary to any stage both during and after development, the subject of next importance pertains to focusing. The exposure directions of chapter one are sufficient for getting a sharply outlined picture, but aside from getting sharp outlines, all lines need be represented in their true relation. In taking pictures of buildings or interiors, or any other objects which present parallel lines, their true representation becomes an important feature of focusing.

**Cause of
Slanting
Lines,**

The direction of lines is controlled by the position of a camera and the relative distances of objects from camera. If a camera tips to the right or left, lines all slant to the right or left, and if it tips down or up, lines lean forward or back. Such faults can be prevented by setting the camera level.

**To Include
High Objects,**

Unless a camera is tipped well up, it cannot include the tops of high objects, and without fittings for the purpose of including high points, there lies a choice between tipping a camera to the prejudice of lines and keeping it level without including those points. The difficulty is partially met by a rising front fitted to folding

cameras which, when pushed up, lengthens the lines of light from lens to bottom of ground glass where high points are imaged. This adjustment then images the entire subject while the camera remains level or nearly so. Notice figure. The full lines represent

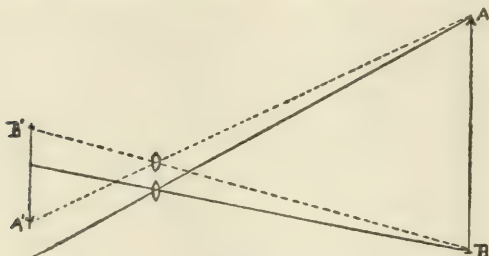


Fig 8.

how rays of light from the top A of an object, AB, would fail to reach the ground glass, B'A'. The dotted lines indicate how, with raised lens, light from both extremities of the object would reach the ground glass.

Distortion. But, while the rising front includes high points, they are not truly represented. Distances vary the size of an image so that objects near by photograph larger than objects of the same size farther away. Or, farther portions of the same object photograph smaller than the nearer portions, the lines which delineate that object narrowing toward the farther end. In a general view, this narrowing lends perspective, an estimate of distance by decrease in size per area. But there is distance up as well as distance back and although the narrowing of lines which represent hori-

zontal distances is desirable from the standpoint of perspective, the narrowing of lines representing perpendiculars is not desirable because the picture would not convey an accurate idea of proportion, especially when the narrowing is lens perspective and not visual perspective. For this reason, a picture of a building, interior, or machine taken without regard to lines would not present symmetrical proportions but a distorted appearance, as in figure 9.

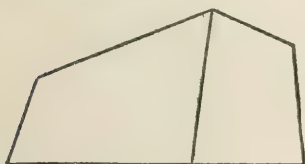


Fig. 9.



Fig. 10.

Figure 10 shows lines well represented. Horizontal lines then may run out of parallel to give distance perspective, but perpendicular lines must remain perpendicular to the ground level and parallel to each other to preserve symmetry.

Distances vary the representation of lines because the angles by which lines of light may reach a lens narrow as the distance of the object from which they proceed increases, and being less separated as they enter the lens, lines from distant objects diverge less as they leave it. Consequently those lines form a smaller image for any position of the ground glass than do lines from nearer points.

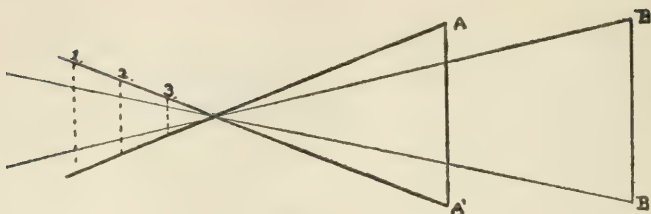


Fig. 11.

The figure may represent several objects at different distances from a lens or the same object at different distances. The crosslines 1, 2, 3, represent any position of the ground glass. Notice that whatever the position of ground glass, lines from BB cover less of the ground glass than lines from AA. In any case then, the image from a farther object must be smaller than the image from a nearer one of the same size or, farther portions of the same object image smaller, causing distortion.

**To Prevent
Distortion.**

The remedy for distorted lines lies with the position of the ground glass. Figure 12 shows that, with a perpendicular position of the ground glass, an image narrows at the bottom. By swinging the ground glass into the position of the dotted lines, the top half is thrown into a position in which the lines of light from bottom of object are less diverged, while the bottom half of ground glass is placed where the lines from top of object are more diverged. This causes a corresponding decrease and increase of those parts of the image until the proportions are correct. A perpendicular swing then corrects perpendicular distortion and is

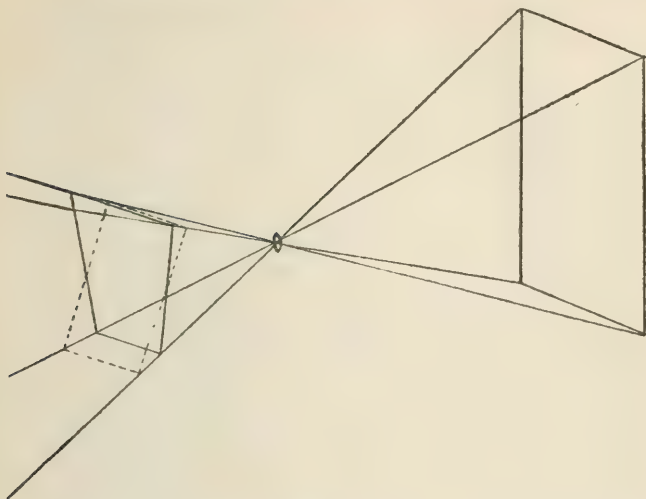


Fig. 12.

the swing commonly needed. The horizontal swing is not often necessary. As already stated, horizontal lines should narrow to represent distance in depth, but occasionally it is necessary to focus purely from the standpoint of proportion, as in copying, making pictures of flat objects, and then the horizontal swing is used only when the camera cannot be centred with the object.

How to Use Tripod and Swings. Even with the knowledge of the reasons for and means of avoiding distortion, the practical difficulty of getting true lines is annoying until one becomes practiced and systematic in the use of tripod, rising front and swing. A tripod is most conveniently

handled when it sets one foot forward and two back so that a person may stand between the two back feet in focusing. With this placement of tripod, a camera can be leveled in any direction. Let the front foot remain stationary, regulating height and pitch of camera by shifting the back legs. To lower camera, grasp both legs, spreading them backwards and side-wise evenly; to raise it, bring them forward and together evenly and to level camera, spread or swing them unevenly. For exposing that requires the use of the rising front, set the camera fairly level, raise lens front until the ground glass pictures the entire object and then swing the ground glass to true perpendiculars. If the raising of lens fails to bring in high points, tip the camera enough to include them. Notice from figure that the top half of ground glass swings in. But if camera were higher than object, ground glass should swing in at the bottom.

As an incidental lesson, the subjects for exposures have thus far included buildings as well as open views. Reference to negatives made in the work of exercises may show distorted images. As an exercise for practice on some of the difficulties mentioned, the following is recommended to those who have folding cameras with one or two swings.

EXERCISE IV, *Practice in focusing lines.*

Required. Camera with one or two swings.

Set up the camera before some such rectangular object as a picture frame held flat against the wall and not higher than the camera. Level camera square with the object so that lens

centres exactly with its centre. Now, handling the tripod according to directions, tip the camera side-wise and notice the slanting lines. Shift the legs forward, backward and various ways enough to notice that every move from the central and leveled position throws lines out of plumb. Centre the camera again and, letting the top of the frame lean out from wall, notice distortion and correct it by swinging the ground glass in at the bottom. If your camera has an horizontal swing also, straighten the picture and propping it out at one side, correct the distortion.

While it is possible to set a camera on a level with some things, it is not always desirable. For practice work in view points looking down on an object, set the camera about five feet high and far enough from a bench or table to get an image of it which covers one half the ground glass. Level the camera in the right and left plane and correct the distortion of perpendicular lines by swinging the ground glass in at the bottom. Again, focus on a building according to directions for manipulation of tripod, rising front and swing and of this, finally, make a correct exposure.

Diaphragms. It is difficult to treat the subject of diaphragms adequately without entering into details which do not well take place in a practical treatise. And inasmuch as the present work is the basis for a later one which shall aim to take up these details, they are substituted in the present discussion by a short statement and explanation of facts from which the applications for practice can be made.

Light travels in straight lines and rays of light are said to be reflected from an object in every direction. Any straight lines drawn from an object to a lens represent paths by which rays of light may reach the lens. All rays that reach a lens in any given case are refracted by it in a definite direction, and whenever two refracted rays proceeding from the same point of a view cross, they are said to form a focus or image of that point. Images from every point in an object taken collectively form a single image of the whole object. Images of points are therefore termed partial images. If the complete image fall in one plane, a ground glass moved into that plane would show it well defined, or a plate placed in that plane would register a well defined image. But if the entire image should not fall in one plane, it would not appear so sharply defined on the ground glass, but be blurred, especially toward the edges. Lenses are made with the purpose of refracting rays so that an entire image will focus in the same plane, as in figure 13. But through such defects as impurities in glass, scratches and inaccurate curvature of lens, some rays are refracted out of their proper course and form partial images near, but not in, the plane of image focus, thereby blurring the image to some extent. The greater share of these misrefracted rays are found to be those which pass through the edges of a lens (see figure 14), and to be rid of them, diaphragms are called into play, as in figure 15. With these rays removed, the remaining image becomes clearly defined.

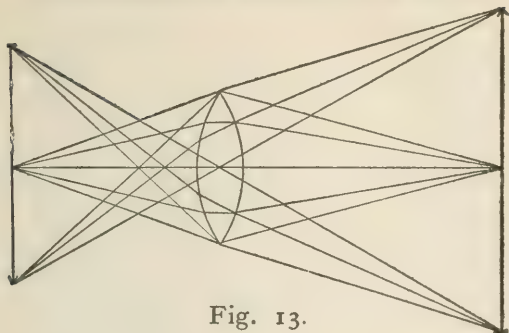


Fig. 13.

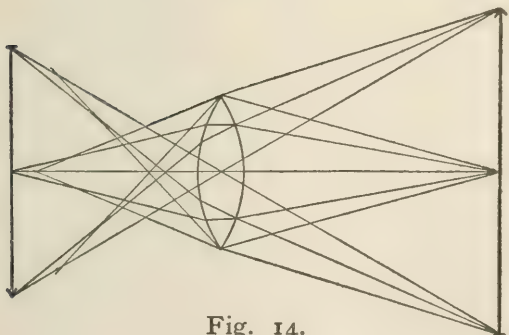


Fig. 14.

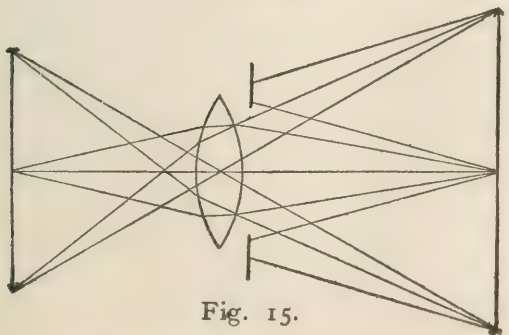


Fig. 15.

**What
Diaphragms
Do.**

The purpose of diaphragms is therefore to increase definition or sharpness. But other results are incidental to their use. Beside increasing sharpness, diaphragms decrease illumination, decrease detail and increase contrast. The decreased illumination with smaller opening is obvious enough. The decrease in detail occurs because some of the partial images which make up the full image are taken away. Do not confuse definition with detail. Detail pictures the parts of a view, while definition distinguishes one part of it from another. Contrast results from a decrease of detail. When one part is left vacant by loss of detail, its vacancy stands out in contrast to the imagery of an adjoining part. Or, from another standpoint, the relative intensities of light falling upon certain shadows and high lights may be as two to ten, each part of a shadow having two image points superimposed, and each part of high light having ten image points superimposed. Say that by the use of a diaphragm both lose an image point; the ratio becomes one to nine, an evident increase of contrast. It is not fair to suppose that a shadow will always lose equally with high lights, but it is reasonable to assert that any loss of light in shadows would make a visibly greater difference than even a greater loss in high lights which are made up of many superimposed image points.

**How
to Use
Diaphragms.**

The points for working application are: Diaphragms decrease illumination, increase sharpness and increase contrast. Since diaphragms decrease the

amount of light which reaches a plate, the amount of light energy necessary to impress an image can only be supplied by a lengthened exposure. Therefore, with given conditions of day and subject, the duration of an exposure depends upon the diaphragm used, and all exposures must be regulated between diaphragm and duration. The first question to consider in determining what diaphragm to use is, does the subject demand the shortest possible exposure, (as with child, animal, moving object). If so, use largest diaphragm. But in the case of a still subject, exposure may be adjusted between diaphragm and shutter at will, and should be suited to the character of subject. For instance, a prairie scene, expanse of water and sky, or any unobstructed and monotonous view is enlivened by contrast—use a small diaphragm, $f/32$ or $f/64$; but, contrasts in nature call for large diaphragms, as in the case of a scene including water backed up with heavy foliage. These examples may serve as hints for special application. Further special applications appear in chapters on copying, portraiture and interiors. As a general rule, use sizes $f/16$ to $f/32$. Intermediate points between those numbered on iris diaphragms can of course be used, but one should be careful to space evenly between numbers in order to calculate exposure.

Diaphragms are numbered by two systems known as the U. S. (uniform standard) system and the F. (focus) system. Their corresponding sizes run in vertical columns of the following table:

U. S. system—	1	2	4	8	16
F. system—	$f/4$	$f/5.6$	$f/8$	$f/11.3$	$f/16$
U. S. system—	32	64	128	256	
F. system—	$f/22.6$	$f/32$	$f/45$	$f/64$	

In the U. S. system, diaphragm 2 requires twice the exposure of diaphragm 1, diaphragm 4 requires twice that of 2 and four times that of 1, 16 requires twice the exposure for 8, four times that for 4 and so on. The F. system is used on most modern lenses.

Diaphragms.—Vary the amount of light that enters a lens—large diaphragms, short exposure; small diaphragm, long exposure.

Vary the sharpness of an image—small diaphragm increases sharpness.

Vary the detail of an image—small diaphragm decreases detail.

Vary the contrast of an image—small diaphragm increases contrast.

As an exercise for seeing sharpness gained by diaphragms, focus on a flat object some 6 or 8 feet away with largest diaphragm. Place a box about one foot deep in front of subject. Observe that it is out of focus. Divide the focus between box and subject and observe that neither seems sharply defined. Stop down and note result.

CHAPTER VI.

**REVIEW,
PYRO,
SPECIAL
TOPICS.**

To simplify the method of presenting the subjects of preceding chapters, they have been handled in the natural order of work, and to some extent, in the order of their importance in work. But for review purposes, another order of treatment will group the topics in closer sequence and give added information.

Thus far four topics have been under consideration—exposing and exposure, developing and developer. From a working standpoint, exposing includes getting a sharply defined focus, getting true lines, using suitable diaphragm, determining exposure and general care in handling plate holders.

**Focusing
and
Exposing.**

If a lens is used with its own size of plate or smaller, as 4x5 lens with 4x5 or smaller size plate, a sharply defined focus can be secured with full aperture, unless the subject is close by. In case the subject is near by, the focus should be centrally located while the lens is full open. This will leave the fore and back parts of subject more or less out of focus. By decreasing aperture with successive sizes of diaphragms, the full subject can be brought into focus. Decrease but one size at a time and if the fore

part or back part sharpens first, the focus can again be centered. In this way the full image is sharply defined with the largest possible opening. A camera must always be leveled, but the use of a swing is involved only when perpendicular or horizontal lines need be kept parallel to preserve proportion. The adjustment of diaphragm and shutter depends upon character of subject, character of light and effect desired. If a subject be movable,—largest diaphragm and short exposure. If a subject present contrasts,—large diaphragm and exposure to suit. If the day is dull, favor bright effects, contrast, provided subject permits the necessary exposure.

Plate holders should not be left lying out in open sunlight. They should be carefully shielded while slide is being withdrawn and until it is again in place. No white light should reach a plate except through a lens and the lens should always point away from the sun. Otherwise, exposure would be obscured by fog.

**Light
and
Exposure.**

The intensity of light on different days, and different parts of the same day varies much. Everyone is familiar enough with the fact in a general way, but differences should be carefully noted in exposing. Light varies with the season too. The shortest exposures come on bright summer days and on bright winter days when the ground is covered with snow. Outside of snow scenes, fall and winter exposing must be long as compared to summer exposing. Subjects also make a marked difference in exposures. Always notice whether the general tone of a subject is light

or dark and expose accordingly. Yellows, browns and greens require more exposure than blue and white tints and bright reflecting surfaces require less exposure than dull surfaces.

The exposure should also be relative to quality desired, an exposure for a dense negative being necessarily longer than one for a negative of medium density and an exposure for soft effect leaning toward full exposure in order that printing density may be developed before the full image contrast has been brought out. The term hard, in a photographic sense, indicates decided strength with pronounced whites and blacks, while "soft" indicates no lack of clearness but subdued contrasts with full detail.

Limits of Exposure.

The limits between which an exposure may vary depend somewhat upon the quality necessary to subject and to purpose of picture, but in general, the shortest possible exposure in any case is one that fully images high lights and shadows, if only faintly. And the longest possible exposure is one in which the high light exposure shall not have penetrated entirely through the emulsion, giving developer a chance to bring up full contrast.

Developers Compared, Ingredients.

Developers have always three principle ingredients; a developing agent, a preservative and an accelerator. The developing agent may be metol, pyro, eikonogen, hydrochinon, amidol, ortol, tolidol, etc., or some combination of two or more of these. Their differences are differences of color effect, density,

speed, clearness with which they develop, keeping qualities, staining or freedom from stain, effect upon skin, suitability to particular plate, etc. When a developing agent consisting of one of these substances, lacks speed or a certain desired color or density, a combination of two will often supply the deficiency. For some purposes, a developer giving extra density irrespective of color is desirable; in other cases, both color and density are particular points. And again, a developer may be objectionable because it stains or irritates the skin. So it happens that the number of combinations catalogued in practice is endless. It is well to understand the reasons which commend one developer or combination of developers over another, not for the sake of selecting one developer at one time and another at another time, but rather, for the sake of selecting one developer which will best suit a person's general practice. It is the bane of photo-workers, especially amateurs, that they are forever trying some new developer. It is enough to contend with the varying conditions which days and subjects present without complicating matters by changing either plate or developer. If changes were made on the basis of a good knowledge of developers, one might be commended for conducting intelligent investigation, but frequently, changes are made from a desire to try something new or, even genuine attempts at bettering results become blind steps through a lack of knowledge. It is essential in practice to eliminate every condition which introduces complexity.

In point of density and speed, developers differ

widely. Metol develops quickly and with little density; eikonogen, slower and denser; and hydrochinon, still slower and denser. Metol develops too little density to be of general service and works so fast that one has difficulty in checking development if a plate is overexposed. Although eikonogen is slower and denser in effect, it would not modify the action of metol as noticeably as would hydrochinon. Largely for this reason, metol and hydrochinon are commonly used together and in proportions of course which give the results one may want in work.

Office of The office of sodium sulphite is largely
Ingredients, that of a preservative, while sodium carbonate or potasium carbonate plays the part of an accelerator. The accelerators are strongly alkaline and every addition of alkali to developer increases its energy. As mentioned in the discussion of restrainers, if developer is too energetic, it affects both exposed and unexposed emulsion, destroying clearness and vigor. So alkali is advantageous as long as it does not bring about muddy development, and if any developer has a tendency to affect unexposed emulsion, it should be used with a diminished quantity of alkali. In case the sodium sulphite used in making developer is alkaline, the developer will work flat, grey and muddy, a lack of vigor and strength. For photographic purposes, sodium sulphite should be neutral. Be careful to purchase only sulphite that is labeled "neutral." Stock developer should not be made in one solution, for alkali works directly against the preserving ten-

dency of sulphite. Preservative and developing agent therefore go into one stock solution which is kept well stoppered, and the alkali makes a second solution. The latter need be stoppered only to keep out dirt.

**Adaptability
of
Developers.**

Of the many points affecting the adaptability of particular developers, those especially important for every day application are:—1, excess of alkali is apt to produce a flat muddy negative, much lack of alkali having an opposite tendency; 2, a developer which stains cannot be used for anything but negative developing; 3, a diluted solution develops softer negatives than a more concentrated one.

Metol and eikonogen are seldom used without hydrochinon and although hydrochinon is sometimes used alone, its very slow action makes it undesirable for general work, and as it favors eikonogen in about the same respect that eikonogen favors metol, the same developing methods apply among them. They can be used several times, develop without stain and keep moderately well, metol keeping best. But marked differences in density and keeping qualities necessitate a change in developing methods. For this reason, pyro cannot be used under the same rules which apply when developing with these developers. (See separate rules for pyro developing, page 87.)

**To Get Quality
Suitable
to Subject.**

One quality of negatives may be suitable for a certain class of subjects while another quality would be best suited to a certain other class. For instance,

portrait subjects are best represented by a soft, mellow negative; but a view requires more vigorous quality, and negatives of drawings and diagrams are best made hard and contrasty. One should have in mind the desirable quality of negative for every subject he undertakes to photograph and work accordingly when exposing, mixing developer and developing. For example, a diagram is to be photographed. It requires a sharp, contrasty negative.—Small diaphragms sharpen and increase contrast; a moderately full exposure permits the use of bromide which increases contrast; developer produces a harder effect when less diluted and with slightly less alkali than usual, and an image is brought out in full contrast by full development of an exposure. Given, then, for subject, a diagram; effect wanted, contrasty. Therefore, small diaphragm, full exposure, undiluted developer with bromide, full development. Or, subject, a portrait; effect wanted, soft. Therefore, large diaphragm, full exposure, extra diluted developer with usual amount of alkali, no bromide (unless overexposed), not developed to full contrast. Notice that both examples call for full exposure but the full exposure is not developed in the latter in order to hold down contrast. In case a subject for soft effect were much overexposed, it would need be developed for hard effect in order to overcome the excessive flatness due to length of exposure.

Bromide preserves clearness and increases contrast but is of little avail in warm developer, the warm solution overcoming its effect.

**Adaptability
of Plates,**

Besides these means toward controlling results, there is also a means in the plate itself. Generally speaking, a slow plate favors hard effects but fast plates work softer. We therefore find boxes containing extra fast plates marked "for portraits" and the slower plates marked "for copying, out door work, etc." For general work, select a plate which works at a medium rate, as Cramer Banner, Hammer's slower grade, or Seed's 26X. It is not advisable for one to work plates of different rapidities at the same time unless he does a great deal of work requiring hard effects and, along with it, a great deal of work requiring soft effects. But it is advisable to use a medium plate in the summer time and a rapid plate in the fall and winter because light varies with the seasons and the hot months spoil fast plates more rapidly than the medium grades.

**Manipulation
of
Developers,**

Often a plate which is slightly underexposed is not known to be so until it has half developed. (Not true with pyro.) It shows an image in moderate time and presents full detail, the lack of exposure not being known until it slackens developing. But this fact adds no difficulty, for only in fresh developer will such an exposure come up quickly, and as fresh developer is its best help, there has been no disadvantage in not knowing the condition of exposure sooner. But the chances of judgment in developing should always be favored toward overexposure. If then, one is using old developer and

the plate seems to come slower than it ought, even under that condition, rinse it from the old and pass to fresh. Should fresh developer prove unnecessary after all, it is an easy matter to pass the negative back again. If a plate started in a bromided developer seems underexposed, let it soak in water for a minute before passing it to fresh developer, because bromide does its work in the emulsion and what had got into the emulsion would still do its work unless soaked out. That plate, too, can be passed back to bromide, if necessary.

**Proportions
for
Special
Purposes.** The following table indicates the proportions of developer, alkali, water and bromide suitable to different exposures and subjects, when using developer mixed according to the formula given on page 18.

For developing plates—ordinary treatment.

Take 6 parts of 1.

“ 1 “ “ 2.

“ 2 “ “ water.

“ one drop of 10 percent bromide to every two ounces of solution.

For developing plates—when overexposed.

Take 6 parts of 1.

“ $\frac{4}{5}$ “ “ 11.

“ no water.

“ (a) three drops 10 per cent bromide to every oz. of developer. Or,

“ (b) one drop 10 per cent bromide to every oz. of developer and enough old

developer to make one third the entire solution.

For developing plates—when underexposed.

Take 6 parts of 1.

“ 1 “ “ 11.

“ 2 “ “ water.

(No restrainer).

For developing plates—portraits.

Take 5 parts of 1.

“ 1 “ “ 11.

“ 4 “ “ water.

For developing gas light papers.

Take 6 parts of 1.

“ 1 “ “ 11.

“ 2 “ “ water.

“ one drop of 10 per cent bromide to every oz. of developer.

For developing bromide papers.

Take same as for gas light papers.

For developing lantern slides and transparencies.

Take same as for gas light papers.

Warm weather, by reason of its tendency to soften emulsion, favors a slight muddiness which falls short of the clear, crisp effect easily obtainable in cold weather. And for this reason, there should be a tendency to lessen dilution of developer during warm weather.

Methods of Developing.

There are three ways of starting the work of developing when a large number of plates are to be run through which are apt to be unevenly exposed. One

method requires a solution of fresh developer, another solution of partially used developer, and a third of partially old developer heavily dosed with bromide, (three or four drops to the ounce) and a tray for each solution. The tray for fresh developer may be large enough to hold four plates, the second tray large enough for two, and the third, for one. With this arrangement, a dozen or two, or more, exposures can be run through inside of an hour's time by starting the plates in the second solution, leaving them there long enough to determine exposure. Those indicating slight overexposure can be finished in the same solution; those indicating correct or underexposure may be transferred to the fresh developer, and decided overexposures, to the bromide developer. Any negative can of course be transferred again if its appearance indicates the necessity. About four negatives can be started this way and then, as one leaves the developer, another exposure can be started, thus keeping the baths constantly working. Such a method gives even results, but it is necessary to watch the partially used bath lest its strength give out and negatives flatten. After the second batch of plates has passed through it, throw it away and, substituting the fresher developer which would then be partially used, mix another fresh bath. Between each change of developer, a tray should be carefully rinsed lest it get dirty and cause pin holes. (For pin holes, see chapter VII.)

A second method starts plates in fresh developer containing a little bromide, about two drops 10 per cent solution to every three ounces of developer.

The plates that develop up well in it are allowed to finish there. Others that come out slowly are soaked in water for a minute to wash out the bromide, and if the detail is thoroughly brought out during this momentary soak, the plates are placed back in the starting solution, but if detail comes slowly, they are soaked a moment longer and passed to fresh developer without bromide. Overexposed plates are, of course, put into a third tray of new and old developer plus bromide. This method is not so popularly followed as the preceding one but it gives excellent results.

Both the methods described start a plate on middle ground and give more control over results than a third method which starts plates in fresh developer and transfers all but short exposures to the other baths. In case, however, one expects to find the plates generally underexposed rather than overexposed, the last method is to be recommended.

But pyro falls under a different rule. **Developing with Pyro.** It spoils so rapidly and browns so **Pyro vs. Metol.** decidedly during the development of a single plate that it cannot be used repeatedly like metol. A second plate started in once used pyro would develop with the effect of a short exposure beside what it would have developed in a fresh solution, and would be badly stained into the bargain. But the great difference between the work of pyro and developers of the metol class lies in the fact that the latter develop full detail from the start and gradually build up strength throughout the details, while pyro, on the contrary, develops first with

strength filling in details gradually. Pyro develops underexposures with decided highlight strength from the start, but the heavy shadows where is little or no image exposure, it develops slowly showing their scanty detail only when high lights have become intense.

**Manipulation
of Pyro.
Rules for
Developing.**

With pyro then, an underexposure develops in great contrast and to prevent this harshness, a plate which is thought to be underexposed or in which a soft effect is especially desirable, is started in fresh developer which is much diluted or in fresh developer which contains but half the usual measure of pyro. The developer, being fresh, retains its full energy, but as that energy is more widely distributed, it is not sufficiently concentrated to act vigorously upon high lights before the extra solution affords some access to the shadows. Thus, while distributed strength causes slower development, the solution has time to soften emulsion and lay the faint exposure of shadows open to the action of developer. Development can then be stopped when shadows are detailed as much as the exposure permits, and while the whole effect of development is less contrasty than would have been the case with a full amount of pyro. But if development is much prolonged, the developer will become so weakened by exposure to air that it is only capable of working in lines of least resistance, the high lights, and this circumstance would after all develop strong contrast. To prevent this, it should be poured off in moderate time and fresh

developer applied to the rinsed plate. If, however, diluted developer is applied to a full exposure for softness, as in portrait work, and excessive softness develops, the addition of enough pyro to make up the full strength will harden the effect. There is, in fact, a greater chance to control results than with metol; but while the chance is there, one is apt, by the rapid spoiling of pyro, to defeat the chance and be worse off than with metol.

Pyro was the standard developer for many years, and is still much used. It is probably owing to this fact that the notion of diluting for underexposures has been needlessly applied to metol. Nor is there advantage with the metol class of developers in the method of soaking underexposed plates in water previous to development; because they do not develop contrast at the start. But for pyro, the previous soaking can be recommended and must be thorough, or transparent spots will develop. The method would soften the effect of metol on a fully exposed plate, but in such a case, dependence had better be placed on diluting developer, because transparent spots are avoided and the developer will keep in good condition during a development prolonged by dilution.

Finally, the rule for developing underexposures with pyro is:—Dilute developer to double bulk, develop for high light density and when they have reached printing strength, cease developing. In case developing is much prolonged, change developer. The determination of the proper density for a correct exposure differs in no wise from the rules laid down

for metol-hydrochinon, remembering, of course, that the amount of contrast is controlled by the per cent of pyro as well as the length of development. The metol-hydro rule for overexposures applies also. They may be effectually retarded with bromide or bromide plus old developer, but care should be exercised in the use of old pyro. It stains badly if a few hours old.

**Keeping
Qualities.**

Pyro does not keep well. It is best made up in small quantities and kept well stoppered (rubber stoppers). Dry pyro is sometimes added to the sulphite and carbonate at each developing instead of being kept in stock solution. But the practice is inaccurate. A well stoppered pyro solution will keep only during weeks whereas metol-hydro, etc., in the same condition will keep for months.

**Metol and
Pyro used
Together,**

The advantages of metol and pyro are often combined by a stock solution including both. The combination works rapidly and evenly, building up detail and strength together. It cannot be used so repeatedly as metol developers, not over three times at most, and not then unless continuously. But this developer has much to recommend it for gallery work. Amateurs ought rather to use a developer like metol-hydro because it can be used in both negative and positive work. As pyro is the density ingredient, the rules for developing would favor those given for pyro developing.

BOTTLE 1.

	Water (hot)	. . .	50 oz. or 1500 cc.
Metol-Pyro	Sod. sulphite crys.	. . .	4 oz. or 122 gms.
Formula.	Metol	1 oz. or 30 gms.
	Pyro	$\frac{1}{8}$ oz. or 4 gms.

Add pyro after the solution has cooled.

BOTTLE 2.

Water	. . .	10 oz. or 300 cc.
Pot. carbonate	. . .	1 oz. or 30 cc.

To use—

Take 5 parts of 1.

“ 1 “ “ 2.

“ 5 “ “ water.

The above is a metol-pyro formula suitable for portrait work. For view work, a slight increase of pyro might be preferable.

**The
Fixing
Bath.**

The fixing bath for negatives can be used repeatedly, if hypo is added to keep up its strength. A weak bath is more to be avoided than a strong one, for in a weak fixer, a condition of emulsion results which even a strong bath can hardly clear out. The effect of a weak bath is seen when two plates lie against one another in the hypo and the part of emulsion protected from bath, having discolored toward a yellow or yellow-brown, can scarcely be cleared. A dirty bath prevents clean fixing and may prove a source of pinholes through dirt sticking to emulsion. A discolored bath is not objectionable as long as it does not stain negatives. The discoloration results largely from developer washed out into the hypo. As pyro

discolors rapidly, a fixing bath used for pyro developed negatives must be changed oftener than one used for metol or eikonogen. About two months use is a safe limit for fixer with latter developers and an average amount of work. An acid fixing bath prevents stain and may always be used for negatives, but, except with pyro developer, the simple mixture of hypo and water without acid suffices. To prepare an acid bath, a half-ounce of sulphuric acid may be added to every gallon of fixer; (stir well). After the white precipitate which forms has settled, decant or syphon off the clear liquid.

To Remove Pyro Stain. To clear out pyro stain from a negative, let it soak a few minutes in a tray of water, to which a few drops of sulphuric acid have been added. Too much acid will dissolve the coating. The cleaning is more thorough if done before the negative has dried.

Chrome Alum. Chrome alum is sometimes used in the fixing bath to prevent frilling or softening of gelatine; but a saturated solution of lump alum (not powdered alum) flowed once or twice over a negative when taken from the fixing bath will substitute the use of chrome alum. Alum is necessary for negatives in warm weather, but only in exceedingly warm weather need chrome alum be added to the fixing bath. Unless absolutely necessary, do not use chrome alum. It often leaves a discoloration and deposit on the film.

Reversal. There is a certain effect which light can produce upon an emulsion beyond

which it can produce no greater—a maximum effect. When an emulsion or any part of it has reached this stage, it is in a condition to develop the blackest deposit possible and any exposure beyond that point reverses the condition of emulsion so that it is less and less capable of developing black deposit. As high lights first reach the maximum, they first reverse and it would be possible by an exceedingly long exposure to bring them down to a lighter developing product than that of the shadows; for, the high lights, because of the greater intensity of light acting upon them would reach and recede from the maximum while the shadows were still approaching it. With a strongly contrasted subject, this state of affairs would present a positive instead of a negative, but usually there cannot be more than a partial reversal because of the intermediate tones between the strongest lights and deepest shadows, and in consequence, an exposure which brings about reversal between the strong lights and deep shadows presents, in general aspect, a weak, confused image which puzzles calculation unless one is acquainted with the conditions of exposure. The matter is mentioned only for its practical bearing. Now and then workers get what seem to be underexposed negatives from an exceedingly long exposure. The knowledge of reversal may locate their trouble. It requires many times the correct exposure to produce a reversal, so that a knowledge of the exposure in any given case will scarcely permit one to confuse reversal with underexposure.

**Special
Points.**

Exposing. — Sharp focus and true lines—diaphragm suited first to subject, and second, to effect desired—exposure depends upon subject, light and diaphragm.

Developing.—Mix developer in proportions to suit exposure and effect desired. With metol, hydrochinon, etc., develop underexposures as long as they remain clear; correct exposures, until full exposure is developed. With pyro or metol-pyro, develop short exposures with diluted developer until the high lights have attained moderate density; other exposures develop as with metol. Avoid using developer too long.

Fixing.—Avoid a weak bath. (This applies to negatives only).

Intensifying. — Only after thoroughly washing negative from hypo. No help to negatives lacking entire shadow detail.

Reducing.—No help to any overexposed plate, unless it has been fully developed.

Restrainer.—Shortens effect of exposure; increases contrast.

Three rules will insure clean work: 1. Always keep hypo by itself, mix it only in its own dishes, and always wash hands from it before touching anything else. 2. Always rinse a tray, whatever its use, as soon as through with it. 3. Keep litter out of work room.

Outside the difficulties that result from carelessness and slovenly workmanship, much trouble results from poor material, which not only envelopes one in

needless confusion, but seriously deter him from doing good work. All plates, papers and some of the solutions used in photographic work, spoil with age. It is a losing economy that patronizes odds and ends sales of such material. The waste in poor results and discarded material consumes more than the extra cost of fresh stock.

**Hydrometer
Test.**

A formula which calls for a solution twelve grains strong hydrometer test means one in which the hydrometer bulb rises until figure 12 reaches the level of the solution. That solution has twelve grains of the substance to every ounce. A bath twelve grains strong hydrometer test corresponds to what is commonly called a twelve grain bath. In measures of weight, every ounce contains 480 grains. Every full ounce of hypo, for example, contains 480 grains. To determine the proportions of substance and water required for a certain strength of solution, divide 480 by the number indicating the strength desired and the quotient indicates the number of ounces (liquid measure) of water necessary for every ounce by weight of hypo. Thus, for a bath 10 grains strong, 480 divided by 10 equals 48. Hence, 48 ounces of water to every ounce of hypo. This serves roughly. A convenient form for the use of hypo is to keep it in saturated solution. A saturated solution of hypo is about 170 grains strong. Dilute this to any strength required by such calculation as above, substituting 170 for 480.

**What Is a
Good
Negative?**

In general, a good negative is one that shows full detail throughout both lights and shadows and has sufficient strength to give a clear print. The necessity of thorough detail is true of negatives for any purpose. But when it comes to a special purpose or a special printing paper, the expression "good negative" becomes relative to that purpose or paper. With reference to a particular paper, then, a good negative is one having thorough detail in such strength and contrast that it all reproduces on that paper. In determining, observe how well detail is preserved. If the shadows print too deep when high lights are printed, the negative is too strong for the paper; but if the print seems hazy and flat, the negative should be stronger. A well exposed and well developed negative makes clear and brilliant prints without muddiness or flatness. Much time and worry is uselessly expended on poor prints when the cause is a poor negative. Practice making good negatives and the work of making good prints will be rid of all troubles except such as are incidental to the use of paper. In general, the glossy surface papers require negatives averaging less strength than do mat surface papers.

CHAPTER VII.

**MEANS
TOWARD
BEST
POSSIBLE
RESULTS.**

The requirements of photographic work include execution, quality and style. Execution necessitates care and accuracy; quality results from close observation, some mental exercise and cleanly work; and finally, style calls for the exercise of a knowledge of fitness and effect which is possible to one in the measure of his qualification rather than the amount of his practice. However little one may be disposed to work accurately and attentively, it is necessary to cultivate that habit in all camera work. One needs be wide awake to every detail of work, but at the same time the mere matters of execution should become so thoroughly familiar as to follow almost mechanically upon observation. Put effort first, then, into the mechanical side of focusing, exposing and developing and observe closely, comparing a subject with those taken before, comparing the day with preceding exposure days, comparing the light in one part of a day with that in another, observing how passing clouds subdue the light, how sunlight may improve the appearance of a brick or stone building, how a subdued light softens heavy shade, how the glaring sun of high noon reflects from water, making it impos-

sible to expose on a shore line and get more than a blank, undetailed patch for water. And in developing, observation should become habitual along the lines indicated by preceding chapters. Execution will follow along these lines, and when they have become more a matter of attainment than of attempt in one's work, style should receive special attention.

In the first sense, not the highest one, photography is technical and requires technical proficiency to a degree that will permit accurate work without strained effort. This proficiency attained, the real effort of one's attention may then be directed toward the artistic and will count for more than it could otherwise.

Style.

Anything that is made to represent and be seen, should represent its subject favorably and in this light, all photographic productions, commercial or otherwise, require attention from the standpoint of style. This phase of the work requires that the make-up of a picture shall be in keeping with its general idea or purpose, and that every care be taken to make it a finished production—pinholes spotted out, heavy shadows subdued in printing, the picture vignetted or opaqued, or masked, or printed plain, as good taste would direct, and then mounted to best advantage, leaving the final print clean.

Soft Effects.

A new worker is apt to turn out landscape views without much thought in regard to their possible harshness or softness. And many old workers, with the emphasized

intention of producing soft effects, practice the extreme of running the ground glass slightly out of focus. View lenses usually have a depth of focus, or flatness of field, which defines objects clearly from foreground to background and, without some care, they favor a tendency toward harsh effects and over definition of parts. Remembering that large diaphragms decrease this tendency and that the softness of a picture does not wholly depend upon its focus or diaphragm, a general adherence to the suggestions on the use of diaphragms (chapter V.) is advisable. But exposures extending into minutes ought not to be made with a full open lens lest it produce flatness. A moderate proficiency and painstaking will add the possibilities of developing and toning toward a production which is at once clearly defined and mellow.

Composition. It is sometimes suggested that the parts of a view be distributed on an approximate and general division of thirds; that a skyline, for instance, be one-third from the top or bottom rather than at the middle line; that the center of interest be rather to one side than in the center of the field of view. The point is, not to get a scale pan balance, just enough on one side to mass up with the other. If possible, a general view should have a commanding interest rather than present a confusion of objects. The simpler sort of outlooks are, in the main, more effective than medleys. Special objects, such as buildings, should not fill a picture but be given some setting in the surroundings.

**Location of
Sun.**

With regard to general views and buildings, the position of the sun should largely be taken into account. A low sun is best for heavy foliage because it lights from a lower altitude and gives a moderate detail in the denser portions which is impossible when the light comes directly from above. And in water scenes with shore line, a low sun glances across rather than shines upon the water, making possible an even-toned picture. But for a view of a wide expanse of water alone, a high sun is not so objectionable, although it requires a very short exposure.

Buildings.

The effect of sunlight upon the appearance of buildings is very important. Structures of brick or stone, more especially, should be photographed with regard to a favorable position of the sun. A building pictures well in full or half-subdued sunlight. In general, high noon is not a suitable time of day. East fronts are best taken during the morning hours, west fronts during the afternoon and south fronts at most any time but noon; but north fronts are difficult. They are best managed when the sun is well toward the west and north. Aim to have the principal front of a corner building in the sunlight.

As far as possible, buildings should be taken from the ground level. They are made to be seen from that level, and high view points show unfinished construction which cannot be seen from the street. Work for bright effects, using medium size diaphragms.

**Cloud
Pictures.**

Cloud pictures, sunrises and sunsets require a small diaphragm and short exposure. With an ordinary plate, one cannot preserve the full strength of clouds while exposing long enough to get the details of a view. Under this condition, it is only possible to expose for the view and neglect the clouds, or to expose for the clouds and fall short of detailing the view.

**Isochromatic
Plates.**

All blue tints photograph with very short exposure, while reds, yellows and deep greens scarcely impress themselves during the same time. To make the effect of colors upon an emulsion more uniform, a plate called an isochromatic plate is manufactured whose emulsion is dyed with a substance which makes it more sensitive to the slow colors. They are made in three speeds, instantaneous, medium and slow, the instantaneous having a slightly slower speed than an ordinary rapid plate and though least effective of the three grades from a color standpoint, is well adapted for use with ray filters.

Isochromatic plates cannot be handled by the dark room light used for ordinary plates because their special preparation makes them sensitive to red light. It is not difficult to load plate holders in total darkness and one had better adopt that plan with these plates. Shield a plate and set it aside from ruby light as much as possible during development, examining it no oftener than necessary, and then only momentarily.

Ray Filters. A ray filter is a flat glass cell filled with an orange colored liquid. The cell and liquid are substituted by more convenient arrangements called ray screens, which consist of colored mica or a colored coating on glass, some of which are fastened to a rim for the purpose of fitting over lenses like a cap.

By largely absorbing blue light and thereby preventing its action upon the plate, filters enable one to expose for the details of a view without overexposing clouds. They can be used with ordinary plates or isochromatics but retard an exposure to about five times the ordinary length, retarding less with isochromatics. But the length of exposure varies so much with the filter used and its condition that one can only rely upon trial with his own filter. An entire exposure with a filter would be flat and lifeless, but by making a preliminary exposure with one and finishing without it, the color values are well preserved in a vigorous negative. If an entire exposure without a filter would take a half second to detail the view, make the filter exposure about one and one half to two seconds, then, after closing shutter and removing filter, finish with one twenty-fifth to one-fifth second. The filter should be removed carefully so as not to disturb the lens.

There is no doubt of the superiority of isochromatic plates or filters, or both, for most view work. They detail heavy greens in foliage, preserve clouds to some extent and in about the same measure, define objects at a distance which are usually indistinct

because of intervening atmosphere and blue horizon. They are especially adapted therefore to distance views, such as mountain scenery. Flowers, too, will photograph with the relative darkness of their natural colors and with the details which appear to normal vision.

To what extent isochromatic plates will be introduced into portrait work is doubtful. They have advantages, but a great drawback as well in point of speed. The profession, too, is always slower about adopting anything new, if indeed, that adjective can now be applied to isochromatics. Whenever these notes recommend isochromatic plates, they, or filter, or both are implied.

**Long and
Short Focus
Lenses.**

Whether or not isochromatic plates or a filter is used, a long focus lens is advantageous for distance views. But for work in limited areas, short focus lenses are better. The view angle of a short focus lens diverges more rapidly than that of a long focus. Where it is impossible to get more than a few yards back from a subject, long focus lenses fail to include enough view. So, for all confined areas, interiors and buildings in crowded districts, a short focus lens comes in play. But for distance views, a narrower angle, or long focus, is more suitable, because even the divergence of a long focus lens covers great width of territory at a distance and to increase the field of view by using a short focus lens would only crowd many more objects into the same size picture, decreasing thereby the

images of individual objects. Objects at a distance then, are photographed largest, and, therefore, most distinctly with a long focus lens, and clearness is further aided by isochromatic plates and filters.

As the divergence of rays through a long focus lens is not rapid, it takes a longer draw of bellows to secure any size image than with a short focus. For this reason, the use of a long focus lens is limited with an ordinary length of bellows. For any work like copying, which often requires the reproduction of an original in equal or enlarged size, both short focus and long bellows are necessary to secure sufficient divergence of rays.

The convertible lenses sold with long focus cameras are short focus, but when the front combination is removed, the remaining lens becomes long focus. The lens ordinarily sold with other folding cameras is a medium length of focus for the size plate used.

**Preparation
of Negatives
for
Printing.** Instead of passing a negative directly from developing and drying to printing, the professional practice is to prepare negatives for printing. There are but few cases where a negative does not require at least a pinhole spotted out before it should go into print. Enough has been said about the general practice of intensifying and reducing to imply that these means should be resorted to whenever development fails to leave a negative with a density suitable for printing. It should become one's practice to reduce or intensify before negatives are set to dry, because once a negative is dry, this work delays

printing until the negatives can be wet up and dried again. One is apt, therefore, to be impatient of the delay and let it pass with the result that either he turns out inferior prints from a weak negative and loses much time printing from an overdense one, or finally intensifies and reduces after a loss of time and prints. If in doubt whether to intensify, dry and proof before doing it. Local intensifying was mentioned in chapter III. A little local intensification of heavy shadows will often even up an otherwise too contrasty negative. Local reducing is more difficult, but can be done by frequent rinsing to prevent spotted reduction.

**Spotting
Out
Pinholes.** The next step in preparing negatives for printing is spotting out pinholes, unless they are portrait negatives. In that case, retouching would precede spotting, if done at all. (See end of chapter VIII. for retouching). Pinholes are transparent spots due to various causes. Those not merely transparent but showing clear glass, as if emulsion had flecked off, are commonly due to dusty plate or holder, sometimes to dirt in developer, and occasionally to imperfections in an emulsion. The transparent spots, where emulsion is not gone, are usually of regular outline, round or oval. They may be due to air bells settling on a plate during development. If a plate or film is soaked in water prior to developing and the soaking is not thorough, these spots appear wherever water failed to penetrate. (See pg. 88).

Whatever the cause of pinholes and transparent spots, their removal is the same; they are spotted out

with a brush and Indian ink. The ink is sold in sticks and this, for convenient use, is rubbed on to a wet glass, which, when the ink has dried, serves the purpose of a palette.

**How
It Is
Done.** Spotting cannot be satisfactorily done by wetting the brush with water and then applying from glass to pinhole. A camel's hair, or sable brush (No. 2 or 3),

is barely moistened on the tongue, shaped to a point with the lips, and ink applied from glass. The knack is not easy. The aim is to fill up with ink to the density of parts about the spot. Overheavy spotting causes white spots in prints. Very fine spots are better neglected, but any size that shows plainly in a print should be filled up. The common trouble with beginners at spotting is that ink gathers about the edges of a pinhole while the center remains as transparent as ever. This result is worse than the original pinhole and usually comes about because the ink is brushed and not spotted on. Do not wiggle or stroke the brush but aim directly for the center of pinhole and when the brush is barely removed from the negative, touch it down. Work slowly and carefully, repeating the spotting movement until the pinhole fills up even with the edges. Too much moisture in a brush will allow ink to run to the edges, causing the same trouble as a stroke movement. There should be just enough to gather ink on the brush and allow it to transfer without running. If the edges of a pinhole become moistened, the work cannot be successfully done until they have been allowed to dry. Heavy spotting can be etched off

retards printing, does not prevent it like opaque, and consequently, shadows are toned down by its use. Application on the glass side prevents its markings from printing sharply and permits washing off, if wrong. Apply by dabbing a moistened finger into the blue and then dabbing the blue on to negative (glass side). By soft rapid dabbing the blue can be spread quite evenly, and, if it spreads too far, can be wiped away at edges. Breathe on the blue while working, if it gets dry. Bluing also requires practice but is not so important as spotting, especially because it can be substituted by bluing on tissue paper pasted over a printing frame, which requires less skill.

CHAPTER VIII.

**INTERIORS,
FLASH LIGHTS,
PORTRAITURE,
GROUPS,
RETOUCHING,**

In passing to interior work, a class of operating is taken up which requires the experience of out door practice. Attention should be paid to the location of the sun and character of light, and special care be given to lines. In addition, the work introduces its own difficulties—there is little light to focus by; the space for work is limited; windows cause halo; heavy shadows increase the difficulty and the disposition of furniture is of some consequence. In a limited space, only a short focus lens will include much width.

Cause of The easiest interior view to work with
Halo, is one which does not include windows and which can be taken without the camera being turned more than sidewise toward them. This avoids halo as well as reflection from the lens; for when the camera points directly toward a window, light striking against the lens causes reflections from it to the plate which, in turn, cause fog. It is the difficulty, on a smaller scale, that is met when a lens points toward the sun. Beside this reflection fog, the halo from an included window is due to the fact that the great amount of light at this

point carries exposure through the emulsion before the darker portions of the room are barely exposed. Some of the light which penetrates through is reflected back in scattered directions by the glass backing and thus expose the emulsion from underneath all around the window.

**How to
Avoid Halo.** The difficulty is avoided by pulling down the window shade and making a long exposure. Then, after covering the lens and pushing up the shade to its proper position, a short exposure, one half to two seconds, will include the window without halo. Another method is to fasten a white cloth over the outside and expose. This inconvenient, but if anything better, method subdues direct window light and diffuses it more evenly throughout the room. Although a subdued light necessitates lengthened exposure, its illumination is much more even and a well detailed picture results. No exposure should include a window when the sun shines directly on it. Interiors usually present strong contrasts between wall and furnishings and sunlight, with the heavy shadows it casts, decidedly increases this contrast.

Backed plates are especially adapted to interiors and other subjects that include white or reflecting surfaces, because the backing absorbs some light that would otherwise be reflected into the emulsion.

**Focusing
Daylight
Interiors.** It is difficult to see well enough to focus on a poorly lighted room. At the same time, it is very necessary to true lines accurately, and where daylight fails to give the required illumination, the ordinary

artificial means of lighting a room may be utilized. But during an exposure, the lights should be turned down, if in a position to be included in the picture or reflect into the lens.

**Diaphragm
for
Interiors.**

Centre the focus as well as possible and stop down the next smaller diaphragm, noticing whether the focus remains centered. Stop down until the focus is sharply defined. One is apt to use large diaphragms because of the extreme length of exposure required. But objects are so near that an open lens will scarcely define them sharply. It is necessary, therefore, to stop down for a clear image, and usually this diaphragm will be small enough to obviate another difficulty, which is, that when exposures extending into minutes are made with large apertures, the scattered light from misrefracted rays prevent a clear image, (page 70.) On the other hand, too small a diaphragm greatly increases contrast which is also to be avoided. When a room is so dark that sharpness must be compromised for exposure, be sure that focus is centered. Openings varying between $f/16$ and $f/22$ meet the requirements of the average interior exposure. This does not apply to interiors including persons, for they must be favored with large diaphragms and are often best taken without sharp definition of surroundings.

**The
Furniture.**

As to the arrangement of furnishings, any large piece of furniture which looms up in the immediate foreground should be removed or a view selected to give it less promi-

nence. But a large open space of foreground gives a room a bare and stiff appearance, as if everything were moved aside to clear space. Break up spaces, but do not allow any object to come abruptly into the foreground when a general view is intended. In a limited space, only a short focus lens will include much width.

Exposure. The exposure required for interiors is too variable a quantity to specify. With favorable conditions of day and light, the average 4x5 camera will expose a plate in 15 to 30 seconds with $f/16$ opening.

Development. A contrasted interior should not be developed to great strength, because strongly lighted places would develop too far beyond the shadows. Favor underdevelopment and, if necessary, slight intensification will then give printing strength without the extreme contrast which would result from developing to that point.

Flash Light with Daylight. Flash light can be employed to good advantage with daylight for unevenly lighted rooms by making a preliminary daylight exposure and finishing with flash directed toward the dark side or corner of room.

When to Use Flash. Flash light is commonly used for photographing groups of evening parties and for interior views. For the latter, it serves well when a room lacks good window or skylight lighting. But pictures by artificial light ordinarily appear flat and monotonous and the means is not to be substituted for daylight, but rather to be resorted

to when adequate daylight is not available or when flash may be used as auxiliary to daylight. Any flash powder should be handled with moderate care. Only the quickest are fairly explosive, but any powder that is of practical service ignites readily and should be cared for accordingly.

**How Much
to Use.**

It is difficult to specify what amount of flash one should use. There are so many flash powders on the market, varying greatly in illuminating power, that it is only possible for an experienced worker to use one powder and discover by trial what amount is required for a given case from which he may reckon for other exposures. For instance, one finds that with his lens and powder, it takes a certain measure of the powder to correctly expose a plate in a room twelve feet square. The next flash exposure might be on a room twelve by sixteen, one-third larger, and hence, requiring one-third more powder.

Powders are often sold in cartridges which contain paper boxes of uniform size, a convenient means of measuring. Others sell in a wooden receptacle, whose cap serves for measuring.

**Differences
in
Powders.**

There is a great difference between flash powders in illuminating power, color of flame, amount of smoke, readiness to ignite and duration of flash. A powder is made up of an illuminant, such as aluminium or magnesium, and one or more other substances added to quicken ignition. The quickening agent may cause the powder to ignite more readily or to

flash quicker when once it has ignited, or it may have the double tendency. The quicker flashes, both because of speed and color, have less illuminating power than slower flashes. which, however, give subjects time to move and close eyes during exposure. The points are mentioned merely to emphasize the possible differences in flashes and the consequent risk one runs in changing from one powder to another.

**Methods
of
Using Flash.**

The usual method of using flash is to spread it out on a board or on the back of a tin plate placed in a position from which it will best light up the room and not reflect into the lens. When using flash by the common method mentioned, it is best not to leave the powder in its wrapper but rather to spread it out over a surface of several inches to distribute the flash as it ignites. It can be ignited by throwing on a match, or by means of a paper fuse, or with a taper. Have hands away from flash when it ignites. Bad burns are caused by it. The fuse is commonly resorted to when the operator wishes to be included in the exposure. Other methods of ignition are by friction, by an electric current and by chemical means. The method by friction is made use of in little metal igniters which explode a match over the powder. The electric current may be utilized by connecting the poles with a light fuse wire led through the powder. This means of ignition has an advantage in that it enables one to place several flashes about a large room in places protected from the view of the lens. The drawback in having flash at places widely apart

is that of cross lights and double shadows from uprights. It is well, when two flashes are used, to let one more than double another, in order to secure a definite direction of illumination, and at the same time, subdued shadows, by means of the smaller flash. They must ignite together. Hence the convenience of the current. A line wire or small storage battery will, of course, serve the purpose.

Position for Flash. Flash should not be ignited in any position from which it may reflect into the lens. It may be placed forward from the camera if shielded in some way so that the brightest flare of its flash cannot be seen in a direct line from the lens, as in the recess from a folding door when the camera stands just back of the entrance. The lens can be shielded, too, as from the sun in out door work (page 15). Otherwise the flash must be placed at one side and behind, or above and behind, or below and behind the camera, depending upon where light is needed. The height for flash is a particular matter in group work, but when it is used as an auxiliary to daylight, the height may be suited to whatever most needs its help. A low position, about the height of a chair, generally answers the purpose. But for exposures on interiors by flash light only, its height is largely governed by the shadows it casts which necessitate a generally higher position.

Flash Light Machines. Flash light machines are nearly as numerous as flash powders. For occasional exposures with 4x5 outfits, the

simple method of igniting flash on a board is adequate and, indeed, is often full as good, if not better, than some of the little devices for this purpose. Large flash machines with rows of powder cups and arrangements for igniting the distributed portions all at once are practical only where the amount and character of one's work warrants the investment.

Method of The method of procedure in making
Procedure, flash lights takes this order.

Aid the accuracy of focusing by the usual means of lighting the rooms. If this alone is not sufficient, set a light at a point where the focus should centre and focus until the flame is sharply defined. After this, true uprights by following their lines with the light and observe finally whether the flame is in focus when placed at the right and left extremes of the view. Now place the powder as close to subject as possible without risking reflections in the lens, guaging the amount of powder by both the distance from it to subject and by the width of view. With everything in place, turn down any lights that reflect in the lens, close shutter while pulling slide, open it again and touch off flash.

Groups by In groups by flash light, the same
Flash Light, order holds. In the arrangement of the group, have care that the camera can be placed on a central line with it, not to the right or left extreme, lest those in the foreground be disproportioned to those farther away, and have care also, that no one is hidden by another. If the flash powder is placed low, subjects cast heavy shadows on each

other and on the wall, and if the flash is high, shadows are prevented, but the clothing, which needs much light, is poorly illuminated. A flash at about two thirds the height of subject and a little to one side compromises difficulties. Do not allow a subject to look at or near the flash. Glaring eyes result. With the flash well removed from a group, there is less chance of heavy shadows.

**Single
Portraits by
Flash.**

Single portraits by flash light afford some better opportunity for creditable results. This field of effort is often engaged in at the expense of a great deal of work to little satisfaction. Flash light has no doubt its proper field where it is the only means, or proves an aid to daylight, but as a substitute for daylight, it seems reasonable that it should be used in practice only as its results in the particular case excel those of daylight. As a rule, practice on single portraits is better given to daylight. But when it is done by flash, the general procedure already described can be followed, and in addition, lighting effects should receive particular attention. The aim is to produce an effect which will duplicate the best effects attainable by daylight. The manner of securing them is therefore derived from an acquaintance with and the manner of securing daylight effects. A principle difficulty is to soften the illumination from such a concentrated and direct source of light. A screen of open weave, like cheese cloth, is sometimes placed before the flash for this purpose. Its use necessitates several times the ordinary amount of powder.

**Portrait
Operating.**

In taking up portrait operating, the notes strike a line of work which is at once most difficult and most interesting. The difficulty which principally appears from observation of beginners at portrait operating is a lack of definite ideas on the subject and a lack of order in work. They will focus and eye a subject in an uncertain manner, and the final choice of view may rest upon a general impression that it looks right but may not have been chosen for definite reasons.

The order of treatment in this subject will first consider a place for work and the equipment necessary for it and will lay out practice exercises involving the use of apparatus and covering simple positions in head and shoulder work.

**Choice of
Operating
Light.**

Although one has not always a choice between several possible places for operating, it is well to be guided somewhat in regard to the most advantageous light to use.

The first object in the choice of a window is to get one which has not direct sunlight on it but gives nevertheless a strong light. A north window seldom receives sunlight, and so photographers aim to have their skylights facing in that direction. Next to a north light, an easterly facing window is the choice, it being free from sun during a good portion of the day, although the fact that sun does shine on it during part of the forenoon and then passes over necessitates a marked change in the length of exposures. South and west lights are more troublesome, and where one

finds it necessary to use them in sunlight, the whole window had best be screened over with bleached cheese cloth to diffuse the light, and subjects should be placed farther away from the light than they ordinarily are. Otherwise, the usual plan of lighting and screening may be followed.

The direction a window faces will not entirely determine its adaptability to portrait work. It is well, if possible, to have a large window and especially one with at least two feet of space behind it. If the room selected for operating has windows in more than one wall, the windows of all but one wall should be screened off. Of more than one window in the same wall, use the one which gives the most free space behind it. Ordinarily, place the subject so that both windows are forward from him, leaving up the shades of both in this case. But if it is necessary to place the subject forward of one window in order to have free space behind him, the back one should be entirely screened off.

Equipment. These abbreviated notes treat the subject of equipment from an amateur's standpoint. If there is any choice as to *lens*, one with large aperture is preferable. The large aperture of portrait lenses, as compared to view lenses, increases their speed and decreases the flatness of field, both desirable points in portrait work. A flat field lens focuses background and subject all into one plain, and to obviate the difficulty as much as possible with view lenses, it is necessary to use the largest opening and focus well forward.

A plain gray wall answers the purpose of a *background*, but if it is figured, a background (head ground) had better be improvised or bought.

Some arrangement for *reflecting screen* is necessary. The usual reflecting screen runs on two feet, stands four and a half to five feet high and has a reflecting cloth of bleached muslin tacked on which measures about three by four feet. And a black cloth tacked on the opposite side makes it still more useful. A light frame work large enough to hold the cloth is a more convenient equipment to stow away in a house. When in use it can be hung on the back of a chair or on the back of an ordinary house screen.

Two pieces of *muslin*, one white and one black, large enough to cover the lower three feet of window, should be on hand for use or not, according to case.

A *head screen* of cheese cloth should be provided. Its purpose is to diffuse the top light and subdue contrast, as well as control the lighting. It is in a light, convenient form when stretched over a loop of wire about two feet in diameter, which is fastened to a wooden handle. It can be held in the hand during exposure.

A *head rest* goes a little beyond the usual amateur outfit, but for more than occasional work, one ought to be used.

An oiled floor or shiny floor covering would reflect light into eyes. Unless the floor is carpeted, it should be covered for a few feet before sitter with something which has a dead and dark surface, especially if sitter wears glasses.

**Exercise in
Lighting.**

*Location of subject with respect to
operating light.*

To get the simplest facts of lighting, have a subject sit about three feet aside and in a line with the centre of a window. Notice the contrast of light on the face and the deep shadows about the eyes. Have the subject move directly back to a point where the face is six inches back of the back line of window. Notice the subdued contrast and that the light extends farther over on the shadow side. Observe also, by another trial, that the side of the face toward the window is evenly illuminated in the first position but recedes to shadow at the back of the head in the second position. A forward position then presents heavy contrasts and harsh face lines, while a position farther back subdues these effects by illuminating more evenly from the front. Next, have subject sit three feet aside and on a line with the back end of window, observing degree of contrast. Change the position to six feet aside in the same line and notice the subdued contrast but weaker light.

Positions forward and toward a light then increase contrasts, and positions back and away from a light decrease contrasts.

Discussion.

If a broad flood of light is thrown flat against an object which has projecting parts, the parts cast no shadows and form is lost. If, on the other hand, a direct flood of light strikes at right angles against that object, projection is lost on the light side and overheavy shadows are cast on the other side. It is between these extremes that an

operator must work. Modeled features in a picture are but the gradations of light and shadow, the projecting parts having strongest light, the deepest parts having deepest shadow, while high lights recede to shadow, not abruptly, but in conformity to the features. From the extremes cited, projecting features would be pronounced by side light but evenly illuminated by front light. If then, a subject be placed in a position to receive a softened side light and some front light, the features will be reasonably pronounced and shadows illuminated. Such a position would place a subject's face six inches or a foot behind the back line of a window, sometimes farther back. A sharp featured person might require a position farther back than a person with flat features for the obvious reason that the overprominence of features in the one case necessitates a softer side light, and the lack of prominence in the other case, necessitates favoring by stronger light.

The distance one should sit aside from a light depends upon its strength, and averages from three to five feet. Every reasonable means must be taken to shorten portrait exposures, and a position far enough aside to subdue contrast would lengthen the exposure. Therefore, the lower side light is subdued with the muslin mentioned on page 119. But the top light is left open to light up the hair and farther side of the face. Much lower light also would reflect in the eyes and light over too far on the shadow side.

Exercise
Continued

How to screen the operating light.

To see the effect of screens, let the window shade clear up and notice the intensity and contrast of light on the face. Now fasten the white muslin across the window at a height level with subject's eyes and observe the decrease in contrast. Remove and replace the white muslin with black and notice that the light is still more subdued. Raise and lower this cloth six inches from its first position to see change in lighting of features. In a bright light with a low window, it would be advisable to use the black muslin at a height of three feet from the floor (this for head work) and above that, white muslin to about the level of eyes.

Direction of face with respect to light.

Leaving the white muslin in place, direct subject to turn his face toward and away from the light. Notice how, in facing it, the features are evenly lighted; how, in a position turned less that way, the light seems to glance across them lining some shadow between nose and cheek on the light side and touching high points of forehead and cheek on the shadow side; and how, in a position still less that way, the light fails to reach the farther cheek, leaving it in heavy shadow and in contrast to the light side, which, on its part, has partially lost the shadow between nose and cheek. The second position gives a desirable lighting. The exact lighting sought cannot often be got by this means alone. That on the forehead for instance, will usually need subduing. But the point is, to get a subject in a position in

which the lighting is as near right as it can be without the use of screens. This lessens the work. So place a subject in that position first and then place the camera where it will take the view desired. But if it happens that the camera cannot be placed for the particular view, the subject must be moved back or away from light and the change of position helped out by screens. But for practice, supposing the right position to be suitable for camera, observe the light on forehead and hair. If seemingly too strong, hold the head screen over and aside until the light subdues. If this improves lighting, the screen should be held there during exposure.

Where to place a reflecting screen.

Turn attention next to the shadow side. Move the reflecting screen toward and away, averaging about three feet aside, and see how the shadow lightens by reflection. After this, place the screen three feet from the sitter and at such an angle that it reflects against the back of head and cheek. While it is in this position, observe the line of reflection extending toward front of cheek and the dark patch running between this reflection and the front of face. Next, move the screen nearer to a parallel with cheek, noting decrease of this effect, and moving it still farther, toward an angle reflecting against the front and side of face, observe that the dark line fades and that the illumination gradually recedes from the strong light of outline to shadow which increases toward the back of head.

A screen should evidently be in a position in

which it does not produce such an effect as that indicated by the first two trial positions. Reflectors should be used as little as possible and never nearer than three or four feet. They destroy soft shadows. Until one has become accustomed to it, he will not detect reflections readily. It is therefore a safe plan to remove the screen a foot or two from the position which shows reflection.

**What
Lighting to
Work For.**

The lighting an operator should aim to get is not so much a disputed question as one varied to the ideas of different workers. There are extremists on this point, of course, but a lighting which no one could reasonably discard as thoroughly bad and which meets the average good taste, is one that presents moderate contrasts and fully preserves the modelling of features.

**Sitting
Posture.**

To see the effect of a leaning position, let the subject lean back in a chair and raise and lower his chin. Then have subject sit well back in the seat of the chair and bring shoulders forward. Notice that the latter position raises chin to a moderate height without the stiffness noted in the former.

**Method of
Procedure
in
Operating.**

An order of work to facilitate operating is important. Subjects get worn out by long work on the part of an operator. The following order will save time:

Place chair in position for the lighting required and let the subject seat himself as he pleases. If

there is no fault in the manner of his sitting or the set of clothing, let him remain as he is. Likely faults are these: A subject almost invariably sits with arms forward. This throws bad wrinkles in the coat sleeves of a gentleman subject. Do not ask him to sit straight, but simply push back the elbows and then smooth out the folds. With women subjects, this correction should be observed to throw life into the pose and widen the shoulders. Another common mistake is the leaning back noted under a preceding heading. This throws the body into a position from which the head does not rest gracefully. Any raising of the chin while the body is in that position would stiffen the appearance and any moderate height or lowering of the face would roll out a double chin. See that a subject sits forward from the chair back enough to let the head rest easily at its proper height and tuck in a support to his back for this position.

The selection of a view comes next in order; then, arranging light, placing head rest, shifting background (if necessary), directing eyes and exposing.

How to Use A head rest is not meant for a prop or
a a clamp, but merely to steady one's
Head Rest. position. Push it gently to the head so
that both prongs touch, but do not push
head forward or allow subject to push against it. See
that it is so placed that its arm or prong does not show
on the ground glass. Careless and unskillful use of
head rests is probably to blame for their general dis-
favor among sitters.

Where to Direct Eyes. Have eyes turn with the head and a little farther than it. Eyes always turn farther than the head in looking at objects aside. But this suggestion should not mislead one into directing them too far around. Do posing, lighting and focusing before directing the eyes at all. Then gauge the direction given them by a look at the ground glass, and, if correct, allow subject to rest eyes until the moment of exposure. Further hints about eyes would suggest that when directed too far toward the light they photograph with an over amount of catch light and will even appear as white patches in extreme cases. The aim should be to get one bright catch light, if the eye is dark. A light eye will, of course, show a subdued circle about the darker pupil. A subject with large bright eyes should be cautioned not to stare, while a dull, heavy eye may be fairly high and slightly dilated.

Expression. Govern expression according to individual and face. A conversational appearance and expression will best bear out the character of a subject, and this may call for animation, dash, passiveness or smiles, but not always smiles. All these can be aided by pose as much as by features. A person should endeavor to avoid reference to the subject while operating, especially with children. If any change, whether in regard to expression or pose, can be made without seeming necessity for it, so much the better.

**Order for
Practice
Work.**

Do not waste much time in first practice work on the choice between possible views. Work rather to get a view which shall be free from any tip of the head out of a balanced position. Begin with front views, from front views pass to three-quarters views turned from the light, to three-quarters turned toward the light and to profiles away from and toward it.

The field in this work is so unlimited and one is apt to indulge so many fancies, that there cannot be progress without practice work in limited lines which shall lay the foundation for creditable results outside the scope of rules. Work with adult subjects at first (head and shoulder work) and only under the most favorable conditions of light and day.

**Front
Views.**

There are four possible views of a face which fall under the general appellation of front views. A front of shoulders with the face turned slightly toward the light is one, and the same position of shoulders with the head turned slightly away from the light is a second. The third and fourth are a side view of shoulders with the face directed respectively toward and away from the light. The choice between side and front shoulder views depends upon their width as compared to the width of the face. Shoulders that appear narrow in proportion to the face should be favored by a square view, and extra wide shoulders can be turned sidewise. For the average proportions, either position may be chosen or other considerations may dictate. A short fat neck, for example, would be repre-

sented at a disadvantage with shoulders side and face toward the camera, because turning the head would roll the skin and thicken the neck on that side. But because of this very circumstance a long neck might appear to advantage in that position. Notice that these positions all have the head facing in a different direction from the shoulders. A difference between the directions of head and shoulders is generally observed because otherwise the appearance of a pose is apt to be stiff or commonplace. This difference, as well as an upward direction of the face, adds dash as it becomes more pronounced. The limit to it is any pose in which the turning of head seems strained.

Pose and light a subject for a front view and then, if a head rest is used at all, place it carefully before focusing.

Views Passing next to views between front
Turned from and profile, the same rules of lighting
the Light. apply. Views showing more of the light than of the shadow side present least difficulty. According to instructions, the subject is located for lighting, and the position of camera then determined by the view wanted. If there is not room to place the camera for that view because the window wall interferes, move the subject farther away from the light, place camera, etc. Reflect light very little, if at all, against the shadow side. This direction of face for views nearly front might require some reflected light, but as a view approaches a profile, the reflecting screen should be farther away or entirely removed and if an opposite wall reflects strongly, the

dark side of screen, or some dark material should be placed in the ordinary position of a reflecting screen to prevent reflections in eyes.

Views Toward the Light. In general, lightings for views toward the light should be more subdued in high lights than views turned from the light and a reflecting screen is usually necessary. With this precaution, views nearing a front are not difficult. But those more to the side require special effort to prevent harsh lights and heavy shadows. It is natural to turn a subject's face toward the light for a side view rather than swing the camera around to the side. But, as far as possible, an operator should adhere to the plan of turning a face in whatever direction permits the easiest lighting. And yet, as views of the shadow side approach a profile, a compromise of position between face and camera is necessary; for if a face is not turned a little, the camera must point almost directly against the window which would cause reflections from the lens and consequent fog. But when a face turns toward the light, the light then extends too far over on the shadow side. This difficulty is obviated in professional work by moving the subject farther forward, thereby shortening the chances of having light spread across the shadow side from in front. The ordinary window is not wide enough to give an over amount of front light, but this means of modifying lighting is mentioned and can be applied in greater or less degree according to width of window. Besides narrowing the light effect, positions forward decrease the

general illumination on the shadow side. A shadow must have illumination. Do not, therefore, move a subject to a point where illumination is lost in order to narrow the light. A head screen will tone down a broad lighting without the loss of detail which results from an extreme forward position. Reflecting screens also aid detail and illumination in these lightings. Detail is preserved in the shadows of black and red hair by powdering in the shadow parts. Ordinarily, thin subjects are best taken in this lighting, because lightings with the head away from light pronounce thinness.

**Choice
of
View.**

The choice of view depends largely on the regularity of features and conformity of outline. An easy sitting posture and relative positions of head and shoulders have been mentioned. With these settled, attention should turn to the outline described by face and head. An outline should be as nearly balanced as possible, not necessarily approaching any particular form, as round or oblong, though extremes either way are to be avoided; but the outline on one side should not be flat or hollow and the other rounding. The conformity of features can be modified by view, lighting and pose; or more closely stated, by view of features, by location of features with respect to the light, by tip and turn of head and by height of camera. Walk about a subject, noticing the outline of different views. Reject any view which fails to balance in some degree. Often an outline which flattens on one side as compared with the other can be rounded by a view including the ear

on that side. A face which is evidently fatter on one side than the other can be helped by placing subject so that the fleshy cheek is toward both light and camera. This throws the thin cheek in a shadow where it is less noticeable, and the fleshy cheek where its form will not be fully modeled because of stronger light and the fact that a camera will not represent its shape so distinctly when including it as a surface as it would when including it as an outline. Profiles especially demand attention in point of outline. It is not true that one need avoid large noses in profiles, but rather, that the chin and forehead should preserve a balance of features and that the back line of head round sufficiently to balance the general outline. To briefly indicate the modifications possible by the height of camera; a high position favors length of forehead and nose, while a low position shortens those features and makes a chin more prominent. A subject with a pug nose, for example, would be favored by a high position of camera, but not so an extra long nose,

**Terms
Applied
to
Lighting.**

Beside the term "broad lighting," applied to those in which a face is turned away from the light, photographers roughly class lightings of faces turned toward a light as Rembrandts.

"Plain lighting" is also sometimes used with the significance of broad lighting. In addition, the term "portrait lighting" indicates the modern drift in lighting effects, which aims to preserve character and modeled features without emphasizing minor details.

The terms have a somewhat varied significance among photographers according to their individual use.

**Figure
Work.**

The lighting directions need be modified for figure work enough to detail drapery. Dark drapery requires low light but white drapery needs be shielded some if in a strong light. The order of operating corresponds to that for head work, and the general idea of balance must be carried out but not confined or applied especially to the head and shoulders. A figure picture should not appear as if the subject would over-balance. This impression is occasioned by the lines of a figure all slanting in one direction. Lines should be broken enough to avoid stiffness and not run to the extreme of confusion. The whole make-up should appear to have a centre of gravity. The general advantage of form and ease takes first rank in point of attention. With portrait outfits, full length work calls for care in focusing, and the swing back must be used to keep the full line of figure in focus.

Sitting postures should always place the limbs sidewise, not directly toward the camera. The obvious reason is the increase in size by forward position of feet, and as urgent a reason, with portrait lenses, is the decrease in depth for focusing. The seat for sitting postures should not be low unless the position is semi-reclining. Pay particular attention to height of camera. Have it usually about two-thirds the height of subject. Avoid any view of hands which exposes their full width to a flood of light. Take them ordinarily in diagonal views with light running

along the exposed line of hand. Favor a lack rather than an excess of accessory. Never use it for the sake of accessory, but for an object, as, to break a large shadow space, to afford rest for subject, to break the lines of a picture.

**Photo-
graphing
Children
Indoors.**

To photograph children, throw open the full amount of light, place subject about three feet from window, use largest diaphragm and reflecting screen. Their fair skins prevent the contrast which would result in this light with adult subjects.

**Head
Groups.**

Head groups of two persons look awkward in positions that present a full width of four shoulders. One or both subjects should turn them to narrow that line and give better chance for posing heads. Let the shoulders of the broader subject fit partly behind the other's and divide any leaning between the subjects. It is sometimes necessary to let the forward person lean back some in order that the other's position may not appear strained. Unless there is reason for not arranging it so, the forward subject should be the farther from the light so as not to hinder lighting.

The line of a group for groups of two and above, swerves a little more toward the light than do single heads in order to help even the illumination at either end and to help get light between faces where one face is likely to shade another. When a blonde and a brunette are together, an even lighting is obtained by placing the brunette nearer the light.

Groups of three heads call for the same precautions regarding shoulders and light.

**Large
Groups,**

In large group work, aim to get the light as evenly distributed over subjects as possible and place the camera in a central line with the group. A single ordinary sized window does not afford much light when the group numbers over three or four people, and if it can be taken in a room which has more than one window in the same wall, arrange the subjects in a diagonal with respect to the windows so that one end of the group is against an adjoining wall and the other swings out in the room. This arrangement will approach a skylight effect but in case there is little light, the subjects had better be arranged in a line facing it. Their distance from the window will, of course, be governed by the space required by camera. This lighting will be flat, but is sometimes the best shift possible in surroundings not adapted to the purpose. When a portrait lens is used, the line of the group must come forward at the ends in order to focus sharply.

**Arrange-
ment of
Large
Groups,**

As to the arrangement of a large group, perhaps the most helpful suggestions are: Begin grouping at a medium height for sitting and standing positions and fill in from there down first, making full use of floor space. This will, in a measure, relieve the crowding in the back line of group which can next be filled in. Build a group up rather than out at the sides, because this grouping accommodates the proportions of a plate and taxes

the covering power of lenses to a less extent. Fill in the gap between people standing and those sitting by grouping in a few sitting on higher forms than those already seated, or, fill in short people standing. Another line of vacancy frequently occurs in the space from sitting subjects to the floor. Break that line by having several sit and recline on the floor and others on low seats. Have a care that no one is hidden. See that the top line of a group is irregular, not running in a straight line or a continuous form. These items attended to, focusing done and eyes directed, exposure can be made. A rapid method of directing eyes is to have all look at one object, as lens, and then change those to whom another direction is suited.

Developing Mention has been made several times
Portraits, in the notes of the soft effect sought in developing portraits, and the directions of page 84 suggest the proportions of developer for that class of negatives. Extra pains should be taken to develop portraits correctly. Ever so careful work in lighting may be frustrated by harsh development. Lean toward underdevelopment. Use the fastest plates. (See pp. 81 and 82). It is better for any great amount of work to keep a stock developer which contains less of the density agent, say one-half the amount of hydrochinon indicated in the formula of page 18 or a very little less of pyro than that indicated in the formula of page 90.

**General
Note,**

The scope of portraiture and group work is too wide to be more than hinted at in such abbreviated directions as the

foregoing, but experience with many beginners and long time amateurs has shown that they have more need of practicing a few facts than of hearing a great many. Systematic effort soon leads to an added miscellaneous knowledge. It would not do for one who has become practically proficient to confine himself to rules. If a picture combines all the necessary parts of balance, lighting and quality, its exception from any conventional style or method is the more to its credit. These exceptions occur in work because of a person's originality and feeling toward effects which are outside the category of their professional knowledge, as far as that has become a science to them. But no one can be ignorant of methods and turn out an average of work that reaches a good standard. Every one should be guided in operating by definite ideas, and they who have in addition the sense that aids them to the unusual are that much better off.

Outdoor Groups. Outdoor groups can be more varied than those indoors. They classify themselves into close groups, scattered groups, groups at work, at recreation, and pictures in which the group or single figure becomes a minor part incidental to the main feature. The procedure in any of these cases should plainly be suited to the character of the subject. The operating for a close group will fall in the line of directions for indoor groups, barring the matter of lighting. An outdoor group should not be made in direct sunlight, if avoidable, because the sun casts heavy and sharply defined shadows across faces, and

even a moderately strong outdoor light causes squinting eyes and wrinkled faces.

Where a group constitutes the main subject of a picture, it should largely take up the view with enough surrounding to give it relief and setting. There are cases, though, in which a figure or figures are introduced to add to or convey the idea of the picture. In such cases, the figures become secondary to the view, and should be made as little prominent as possible and yet convey the idea intended. Have attention of figures drawn to the subject of a picture and not to the camera. Whether figures are introduced at all depends upon appropriateness. A wild spot, for instance, would be more truly so in its own trimmings. More domesticated scenes might or might not include figures, and perhaps equally well either way. The purpose of any picture would then be a determining factor.

Have most anything but sky or water in the background of faces, for in this circumstance, they become mere dark patches against a white ground.

In leaving this subject, it seems fit to emphasize the field that is open for photographing in special lines like those of types of child life, and of people in their surroundings rather than apart from them, as of home people in and about the premises, as they leave and return, and the like.

Retouching. This branch of photographic work is followed by many as a specialty, and one that a person seldom takes time to acquire for pleasure alone. Not all who try the work can do it, nor can a

a large percentage of the professional workers do first class work. The learning requires much practice and patience and is not greatly helped by reading, but should be conducted under supervision.

Because retouching is commonly overdone, its necessity is as commonly underrated. It is not true that a portrait negative should remain as it comes from the operator. Freckles and spots that are scarcely noticeable in one's face register very plainly in a negative, not because they are really in one's skin, but because the shortcomings of the photographic plate make it impossible to picture these blemishes with their true tone values. And in addition to this, a lighting will often exaggerate blemishes beyond their real strength, certainly beyond what they appear to an average observer.

The just ground of retouching then is to remove the overprominence of blemishes in skin and subdue face lines; removal of straggling hair and little alterations in drapery are also permissible. But beyond this, the average photographer and the average subject as well, demands modifications. The handling of this topic would not therefore be complete without treating of the work as it enters into every day practice, leaving individuals to adhere to the justifiable standard in this line in so far as their own wishes are allowed. Happily, the tendency among the higher and modern class of workers is to confine retouching to its place.

In its general significance among photographers, retouching includes all such work as spotting, etch-

ing, or bluing that may be necessary to prepare a negative for printing. The term is not applied to any work on prints, for there spotting is included among the last touches which class together under the name finishing.

Equipment for Retouching.

The equipment for this work is not elaborate. A *retouching stand*, for which the figure gives dimensions, is needed. A *head cloth* should be thrown over it when in use. A circular inset cut around this hole just large enough to take in a negative and deep enough to let it come flush with the surface makes a most convenient means of holding a negative in place and at any angle. The bottom board of stand also is covered with white cardboard to reflect light against the negative. Stands are made with reflecting mirrors fitted into this piece, but a bright reflected light taxes the eyes. Do not use a mirror. If the parts are hinged together, the frame can be folded up and stowed away. Fasten a piece of finely ground glass at back of hole on the opposite side from negative. The glass should be of the finest grind and be removed at least a half inch from the negative.

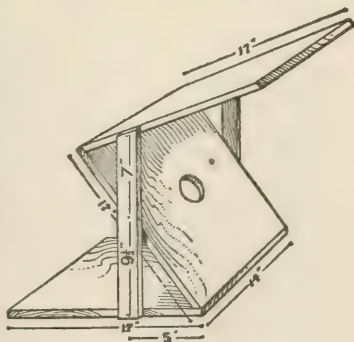


Fig. 16.

Beside this, a *lead holder*, *leads*, *retouching var-*

nish and *pencil sharpener* complete the list. The Faber leads, usually HH and HHH, are used. For sharpening the leads, tack a piece of fine sand paper on a block of wood about two by six inches. Grind a lead on this to a fine tapered point. Have not less than one inch of lead extending out of holder and do not use a lead so short a stub that it becomes unsteady in the holder. Retouching varnish, commonly called "dope" to distinguish it from negative varnish, can be bought, or made up according to the following:

Retouching Varnish, How Applied.	Venetian turpentine . . . 1 part. Spirits of turpentine . . . 2 " To a two or three ounce mixture add a pinch of powdered rosin. Shake well. As the dope thickens with age, thin it with spirits of turpentine.
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The dope is applied to negatives as a medium to which lead will adhere. A drop or two is dabbed on to the parts that require retouching and spread evenly over its surface with a piece of cotton flannel or cotton. The tooth of this medium varies with the manner in which it is applied. If rubbed down hard and shiny, the surface will not take lead easily. If left thick and uneven, the lead will catch in lumps, making a mussy piece of work. Rub hard enough to lay it down smooth and evenly, but not so vigorously as to leave a hard polish. It should be rubbed hard and smooth at the edges to prevent a decided line there which would show in printing. On moist days, heating a negative until comfortably warm

will improve the tooth. There are numerous mixtures for dope, and one variety or another can always be bought at the stock houses. Sometimes retouching is done on a surface ground with *powdered pumice stone*. The powder is rubbed over a face in every direction with the fingers until the surface appears ground, and is then cleaned off. There is danger of scratching a film if the powder is not fine and clean. Rub slowly at first to detect any grit. It is advisable to have a small supply of the powder on hand to use occasionally on an especially shiny film, as on a reduced negative or one that has been over-hardened. Dope applied over grinding gives a surface an evenner tooth, cleans off the powder and holds the lead, which, with powder alone, is apt to brush off somewhat in after work.

Negative Varnish.	Sometimes a negative works smooth in spots, making it impossible to finish retouching on that surface. This circumstance is often the fault of the
How Used,	retoucher, but when necessary, a negative can be flowed with negative varnish and work done over it by doping as usual. This coating must be allowed to harden a few hours before it can be worked on. Some photographers varnish all their negatives to protect the film. This custom has its advantages in protecting the film from scratches and in covering retouching so that there is no risk of rubbing it off. But among the disadvantages are: the liability of dirt in the varnish, or of its collecting dust while drying, or washing off part of the retouching; the liability

also, unless it is well seasoned, of paper sticking to negatives. Season varnish by laying negatives in the sun for ten or fifteen minutes and then letting them cool. Ready prepared varnish is sold, the leading kinds coming under the names Flint varnish and Adamantine.

Heat a negative enough to drive out surface moisture, until barely warm; then flow varnish over the film side of negative, pouring it on near the upper right corner and flowing it around to drain off at the lower right corner. Use only enough to comfortably flow the plate. Do the flowing leisurely, and as the varnish runs off, tip the plate back and forth to prevent it from settling in streaks. Warm the plate a very little also as soon as the bulk of excess varnish has run off; but do not expose that side to the flame lest it catch afire. This heating is to prevent chilling. On a cool plate, varnish will coat thinly and whiten; hence the term, chilling. Too much warming leaves a thick streaky coating.

If a coating needs be removed for any reason, soak the plate in alcohol. This is necessary when a paper adheres enough to leave crack-like marks or when the varnish is dirty. But if ever paper sticks to the surface, soak the plate in alcohol for a moment just enough to remove it and the bulk of varnish and then soak the negative in a hypo bath for a half hour to prevent staining. Never delay after a paper is once stuck. If not varnished, carry the negative immediately to hypo. Stock varnish thickens readily, but can be thinned with alcohol whenever neces-

sary. It must also be kept well filtered. Keep two bottles for flowing, one stoppered and the other fitted with a small funnel and absorbent cotton. Pour on to negatives from the stoppered bottle and off into the funnel. When stoppered bottle empties, change funnel to it and use from the other.

Retouching The light for retouching is a very
Light important matter. There may be too

bright a light as well as too dull, and if preference leans either way, it should favor a dull light, for then one is apt to underdo rather than overdo; and while it may have a tendency to tax one's eyes, it certainly has not so evil an effect upon them as a bright glaring light, which also pronounces minor details, leading a person to pencil on an amount of lead that destroys the life of a negative. A retouching light should be soft and white, never glary. It should therefore never be direct sunlight. If necessary to use a sun window, mellow and whiten the light with a light shade of blue tissue paper. Suit the strength of any light to the strength of a negative by using the window shade or with screens of white tissue paper. fitted against the window. Try to gauge the strength to one that plainly shows the bulk of blemishes throughout a negative. The room too should be darkened, except from this one window. Any light reflecting against the face of a negative confuses clear sight and strains the eyes.

The question is often asked, is retouching hard on the eyes? There is no reason why a judicious amount of retouching per day should hurt normally good eyes

if there is proper care about the light. But one hour's work in a glaring light taxes the eye, and so it would in a very weak light.

But looking at the matter another way, eyes are often hard on retouching. Unless they are normal or fitted with accurate correction, there is no use attempting the work. Of course, any physical ailment or indisposition, temporary or otherwise, which affects the eye, will affect retouching in like degree.

**Artificial
Light
for
Retouching.**

Artificial light is used to some extent to help out the short winter days. A good artificial light does very well; but a person ought not to use any artificial light unless it is first class. Very few oil lamps make a satisfactory light when the yellowness is toned down. But fifty candle-power electrics and gas mantle lights can be suitably arranged. They can be used with an ordinary retouching stand, but a three-sided box with slanting front and open at the top and bottom shuts off reflected light. To fit out a fifty candle power, grind one side of a blue glass with fine emery powder and water, by rubbing one glass against another, and slip this in place of the white ground glass. Back of this fasten a sheet of white tissue paper, or, if the light is still yellow, a piece of light blue tissue. Do not draw the tissue tight across. Let it loop a little. If blue glass subdues the light too much, use instead blue tissue or blue and white, depending upon what combination whitens and subdues the light correctly. Sometimes a flat bottle filled with bluing is substituted for these. The color

can be regulated by the amount of bluing and it should be renewed from time to time as it fades. An opal shade over a gas mantle furnishes a soft though yellow light.

How to Retouch.

The first rule in retouching should be to do what is needed with as little lead as possible. So whether it be a spot or shadow, keep within the bounds of that spot or shadow. Directions for retouching often recommend certain strokes, as straight, or crescent shape, or more rounding. But the fact is that retouchers seldom work with like strokes; some work with no particular stroke and none can adapt a particular one to all parts of every negative. Perhaps the closest general suggestion would be to adapt the stroke to the grain of the skin, running strokes on any one part of a face in the same general direction, as far as possible; for if strokes cross a great deal, the work is apt to be mussy, not clean and stippled. At any rate, it is more important that a beginner pay attention to getting out blemishes with the least possible lead than to acquiring a certain stroke.

Begin carefully then, and make it a point above everything else to keep within the bounds of each spot. This will necessitate a very sharp pencil point, which will need be resharpened as often as it dulls. Do not neglect sharpening. Touch lightly and pass from spot to spot. Work always from highlight to shadow. It is customary to speak of highlight and shadow as they appear in prints. The darkest portions of a negative then are highlights and these grade

down to the lighter portions, or shadows. Skin blemishes show dark in a print and are therefore the semi-transparent spots and irregular shadows of a negative. They are the defects which require first attention.

**Method
of
Work.**

To start work, dope a negative, sharpen pencil and arrange the light according to the preceding instructions. The negative should be a head, measuring at least one inch across and of average density, one that details highlights and shadows. Before using the pencil, distinguish between blemishes, character marks and face lines. The next step is to apply lead in a manner that will remove blemishes without touching out the character, and then to model face surfaces and modify lines without destroying resemblance. Start in the forehead, beginning with small spots, and, as they work out, larger spots and shadows will show. Remove such of these as are not character marks or face lines. After going over a little space in this way, sit six or eight inches farther back from the negative and notice that larger and less defined shadows are apparent, making an uneven appearance.

The eyes detect blemishes in a negative according to the distance one's head is removed from it. Small spots therefore require a close range and larger spots, not so close. The retouching of every part must be in relation to parts about it and because the eye takes in portions of a negative at close range and surrounding parts at longer range, one should be

careful to sit back every little while to see that the work is finished as it goes and that the relation of parts is preserved, one part not being built up to such an extent that others will need be built up more than they otherwise would simply to meet it. Small heads, of course, require generally closer work than large.

Try throughout to preserve all the lines, high lights and parts of the face, touching out any blemishes within them, but no more. Aim, in fact, to strengthen such highlights as that on the line of the nose and the highlight surface which defines the chin.

An unfinished negative, or any unfinished portion of one, has a mottled appearance; not many abrupt shadows, but a general unevenness. The appearance may be modified by blending off from highlight points. This part of the work is called modeling, and upon it the cleanness and character of the work largely depend. If overdone, the face is stuffed; middle tones and softness are lost. If underdone, the fault is a good one and needs only more work to correct it. Modeling should be carried along with initial work.

With retouching carried to this point, there remains the modifying of face lines. They are properly attended to here because a negative is finished in all but that respect and one can see the exact relation of lines to other parts as modifying proceeds. Never work directly across or directly with face lines, but diagonally across them. The characteristic direction of every face line lies in its deepest part, and to preserve resemblance and character, modifications should work toward and not begin in these parts. On

this plan, wrinkles, which deepen at the central line, can be blended across from either side. So also of lines or shadows under the eyes. Often there are two shadows under each eye, and in such case, the lower may be somewhat toned down. Lines from nose to mouth should be blended from the outer edge in and may be shortened a little at the lower end. But do not work against a nostril or the shape of the line defining it will be destroyed; blend that line from the outer edge so that it will round in from the cheek and not become a mere streak. So also of lines at the corners of a mouth. They may be blended and shortened, but the crease exactly at the corner should be left as it is. Next, the line or surface defining cheek from neck may be subdued. It often appears irregular, usually on account of lighting or blemishes rather than its actual shape. The irregularity may therefore be softened. Touch out also any straggling hair that may be objectionable and finish a negative finally by sitting back from it to correct any lack in modeling. This is best done after a negative has been laid aside for a few hours when eyes have rested from its particular appearance. Spotting follows retouching. (See pg. 104).

There are comparatively few retouchers who finish their work. A retoucher for the trade should always look over a negative after it is supposed to be done, to see if modeling is finished, if pinholes are spotted out, whether straggling hair needs be penciled or etched out, and whether drapery needs pointing up with lead.

Retouching may be removed from a negative by doping over it, or better, with alcohol. But a negative never has as good a tooth for the second retouching as it had for the first.

Eyes and Etching. None but a practiced worker should meddle with eyes. They often need etching to subdue or shorten catch lights. Etching removes black parts and is done with a sharp knife point. The blade must be firm and have a keen edge in order to scrape any portion of film down to the density of parts about it. Bony necks, straggling hair, faulty outlines and heavy spotting are remedied in this way. Expert etchers can work in an entire background. It requires skill, but skill is of no avail without a fit tool.

Bones are sometimes etched down with alcohol. A piece of cotton bound over the end of a spotting brush or stick is dipped into it and rubbed over the parts to be etched. Work by littles, keeping the surface free from excess alcohol with a dry tuft of cotton.

Further Directions. A person can make some progress in practice by proofing negatives before and after retouching. Take the work leisurely; make every stroke carefully. For the first few days, do not practice more than one hour at a stretch and not more than two or three hours in the course of a day.

The usual trouble with beginners is that they run over the edges of spots and shadows, blackening the already dark edges and necessitating more lead on the

spot to even up with them. In this way spots are often worked over so much that the surface gets shiny in those places and will not take lead in consequence. It also piles up much more lead than is necessary, giving a face a mussy appearance, even if one succeeds in filling the spots.

Written instructions for retouching cannot be more than general. They can become specific only when applied to particular negatives. One needs first to learn to put on lead where and as it is wanted. As every negative presents its own peculiarities, further proficiency is gained only through general retouching experience.

CHAPTER IX.

COPYING. In general, the light on anything to be copied should be even; the lens should be centered with it; the diaphragm, small; the plate, slow; exposure, full; development, strong and clean.

Any subject for copying has a flat surface. There is therefore no perspective to represent—only proportion, and any position for the camera out of a central line for such a subject would misrepresent its proportions unless swings could correct the distortion. So, in copying, the centering of camera and use of swings are particularly important.

By Daylight. When light reflects unevenly on to a picture, some portions of the copy expose more rapidly than others. An exposing light should therefore be evenly distributed.

When this work is done by daylight, place the picture in a position, with respect to light, which will give even illumination and permit free play for camera. For example, when placed at the back end of a light and turned slightly toward it, a picture receives all necessary illumination and a camera can be squared with it without obstructing the light. If one side of a picture is darker than the other, it can be placed toward the light and at a slant that will brighten it.

This enables one to produce a copy which is more evenly lighted than the original.

**By
Artificial
Light.**

So also when one is using artificial light, it may be thrown on to a picture from the darker side to even illumination.

In copying by artificial light, the light may be direct or reflected, may be from one source or two. Direct light passes straight from its source to the picture. (Figure 17.) Any concentrated direct light

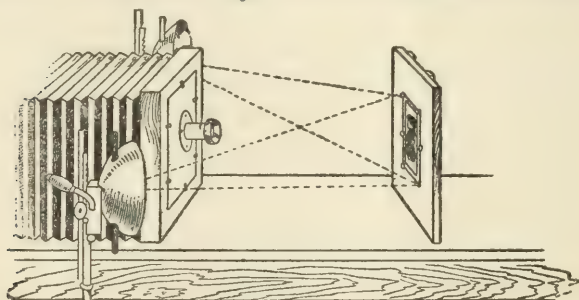


Fig. 17.

reflects across rubs, marks, cracks and curling surfaces, which develop as black streaks. This commonly occurs when the illumination is from only one source; but by turning a picture partly away from a single direct light the reflections can be largely avoided and illumination evened. Direct lights from opposite sources kill one another's reflections and largely prevent these black marks. This arrangement can therefore be used to advantage.

Reflected light passes to a reflecting surface and from that is thrown against the picture, (figure 18).

The reflector for this purpose should not have a too highly polished surface, though a smooth white cardboard is all right. A light reflected from either one or two sources is less harsh, though slower, than if it

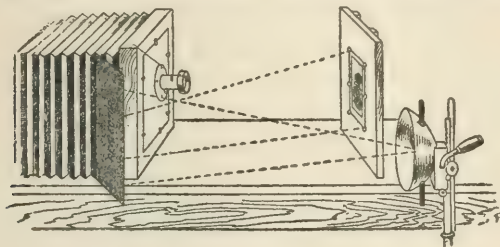


Fig. 18.

were direct. It is diffused, scattered, does not strike a picture from only one point, and therefore exposes a copy without harsh reflection lines.

Artificial light, being more or less yellow, acts like a filter screen before a lens and gives better detail from red photos than does daylight. Anything in colors is ordinarily best copied with isochromatic plates.

In addition to the arc light, magnesium ribbon and flash powder are occasionally used for copying. They will answer for a makeshift in special necessity. Acetylene gas or gas mantle lights can be used to advantage for copies of originals measuring not more than 8x10; but there should be a light at each side.

Lens for Copying. A flat field lens is best for copy work. Portrait lenses are not of this character, but view lenses, being much more so, are especially suited to copying. There are lenses made for reproduction purposes, as the Planar lens,

which focuses in an extremely flat field. They are meant for use in zinc etching work and the like.

About a nine inch focus lens for an 8x10 camera with extra long bellows allows a wide range of work. A long focus lens would not always enlarge as much as desired, and the disadvantage of a very short focus one would be that the box could not always be closed up short enough for a small image.

**Camera
for
Copying.** Copying cameras with extra long bellows are sold in both 4x5 and 8x10 sizes. The 8x10 is adapted for copying to enlarged and reduced sizes and for lantern slide work. The ordinary folding cameras, by reason of their short bellows, can only copy to reduced sizes. An open ended box with a ground glass and plate holder attachment fitted to the back of a folding camera would enable one to copy an original in equal or enlarged size, according to length of extension. Six or eight inches is a convenient length for the extension. A double extension folding camera is well adapted to copying.

**Diaphragm
for
Copying.** The diaphragm should usually be small, but there may be extremes on that point. As a flat object must be focused in one plane; that is, in a perfectly flat field, and only small diaphragms focus rays in a flat field, large openings ought not to be used for copying. Moreover, with an open lens, copies lose clearness; middle tones are not distinguishable because not defined against clear whites. With small diaphragms, however, copies gain clearness but lose

middle tones, and there is increase of contrast. Everything considered, small diaphragms are to be preferred. But extremes of contrast cannot be permitted in portrait copying or in copying any subject which has middle tones between strong highlights and strong shadows. There must be a small enough diaphragm to enliven the whites, and if the original itself is vigorous, there might not be need of a smaller than $f/16$; but if the original is flat to begin with, the subject, whether portrait or not, requires a smaller diaphragm.

It makes a difference too whether the original is reduced or enlarged. In enlarging, outlines are magnified, and because magnified, are not so sharply defined. An enlarged copy then requires a diaphragm that will preserve as sharply defined a picture as possible, a small size. But in reducing the size of an original, there need be no more than ordinary precautions for preserving sharpness. Again, a picture made up of simply dark lines against a white ground or vice versa, such as cuts, blue prints and drawings, are best represented in contrast and require the smallest diaphragms.

In general, suit diaphragm to subject, always using small enough to give vigor in the reproduction, and decreasing the size of diaphragm still more if the original is being enlarged.

**Glossy
Versus Dull
Surface for
Copying.**

Any glossy surface copies better than a mat, because the latter reflects light in spots, giving a speckled reproduction. Mat surface photos, no matter how good in themselves, make poor reproductions.

For this reason, pictures sent to a copying house for half tone reproduction should not be on dull finish paper.

**Directions
for
Copying
Particular
Subjects.**

The following table enumerates the most favorable conditions for reproducing subjects that come in the usual run of copy work.

To copy from red and brown photos.—Artificial light; diaphragm $f/16$ or $f/32$; isochromatic plate; regular developer; develop to average strength. Second choice.—daylight and the rest as stated.

From photos in black and white.—Daylight and ordinary plate; otherwise as for photos in red.

From cuts; line work (diagramatic).—Daylight; small diaphragm, $f/64$ or $f/128$; developer as for overexposed plates (page 83); develop to moderate strength. The clearest black and white negatives can be got in subdued daylight. Bright daylight seems to cause reflections from the white background across the black lines of a cut, preventing clear contrast. Take every precaution to secure contrast. See page 81.

From wood cuts, engravings and line work (not diagramatic).—In general like the preceding; but cuts grading from heavy blacks to middle tones should be worked with less contrast—use $f/32$.

From cuts in brown tones or on yellow paper.—Artificial light and isochromatic plate; $f/32$; ordinary developer; (page 83); develop to moderate strength. Daylight for second choice.

From half tones.—If muddy, as is often the case with cheaper cuts on poor paper, operate as with line work (diagramatic). If clear and good gradations of tone, work with less contrast— $f/32$; ordinary developer (page 83); develop to average strength.

From maps.—Daylight, especially because they are generally too large to be evenly illuminated by artificial light; sometimes ordinary plate, sometimes isochromatic. If it is advantageous to show lines irrespective of their color value, ordinary plates are better. For instance, fine brown lines would show but little with isochromatic plates but stronger with ordinary. If color values are sought, use isochromatic.

From drawings on manila paper.—Daylight and isochromatic plates. Otherwise as for line cuts.

From drawings on tracing cloth or tracing paper.—Fasten drawing against a white cardboard to give a clear background to design. Daylight; ordinary plate; otherwise, same as line cuts.

From blue prints.—Isochromatic plates. Otherwise the same as line cuts.

From daguerreotypes.—Daylight; $f/32$ or $f/64$; ordinary plate and developer; develop moderately strong.

From tin types.—Daylight; isochromatic plates; $f/32$ to $f/64$; develop moderately strong.

Mounted pictures can be fastened against a wall or upright board. Flatten an unmounted print against an upright with a glass fastened over it. About the best one can do with a wrinkled map, too

large for a glass, is to fasten it as flat as possibly with thumb tacks.

The background or parts of a copy may be blocked out of a negative with opaque, if necessary. (See pp. 106 and 159).

To copy a negative from a negative, proceed as in lantern slide work, by contact or with copying camera. (See chapter on lantern slides). Often a cracked negative can be duplicated by this means. If the glass only is broken and film intact, a duplicate made in the copying camera will show the crack very little, if at all. But if both film and glass are broken, a duplicate would be apt to show the crack, though not so plainly as in the original.

A convenient support for copying cuts from books can be made like that shown in figure 19.

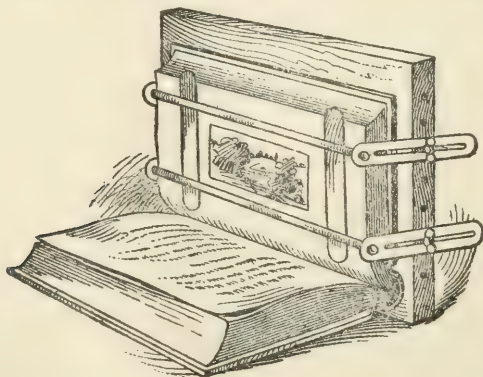


Fig. 19.

Fasten the rods with thumb screws, which screw into small brass plates flush with the edge of the wood.

Screw holes in the wood alone lose their grip by wearing. The straight lines under rods represent loose sticks, put there to help keep the page flat.

An important and particular branch of operating comes under the class **Commercial Photography**, known as commercial photography; the photographing of furniture, glassware, silverware and other merchandise for catalogue reproduction and agent's use.

The particular points in *furniture* work are to get an even illumination, perfectly true lines and sharp focus, full detail, showing grain of wood, and a nicely opaqued ground. In professional practice, all furniture operating is done before the pieces are varnished. A piece should be set well back to receive a full flood of front light. Place it at an angle that evens the illumination and, as far as possible, prevents shadows from projecting parts. Use a rectilinear lens, develop to clear strength; opaque all around outlines and print on gloss paper. Opaquing is careful rather than difficult work. A small brush held against a rule will best trace the outlines and a larger one will better fill the mass of background. (See pg. 106). Furniture prints are commonly squeegeed and mounted on cheese cloth. (See mounting, chapter 10).

Glassware and *silverware* require special precautions against strong reflections. Glassware is sometimes covered with a white pigment applied with an air brush; and silverware is often smeared over with oil and putty. Such subjects should be well

screened from direct light. Every case requires exercise of judgment to suit background to subject, to see that the piece rests upon something which reflects or prevents reflection from beneath, as the case requires.

Drapery subjects, such as hoods, handkerchiefs and window curtains, require soft detailed negatives. There should be special care to observe every possibility of showing the full pattern. Hence, subdued light, even illumination, well focused, but not too dense negatives.

As far as *machinery* comes under this heading, it classes with the directions for furniture. Machinery is sometimes painted over with a light color to detail parts, and the nickel work is also sometimes deadened by such means as that mentioned for silverware. But machinery is commonly photographed where it is in operation, and, in this case, the use of flash with daylight is recommended, if the daylight is weak or uneven. (Page 111).

CHAPTER X.

**MAKING
POSITIVES,
CLASSIFI-
CATION.**

All photographic processes depend upon securing a picture by the agency of light. Either an image is secured in full strength by light alone, or light as a starter, plus a developing agent to intensify and add to its work, accomplishes the end. And as would seem natural, that method which depends upon the agency of light alone is a slower method than that which employs it for only the initial step toward an image. In negative making, the light plus developer method is used exclusively, every requirement of the work making any but the quickest one quite out of the question. But for making prints, both methods are in popular use, and by the respective means of securing an image, photographic papers are designated as printing-out papers or as developing papers.

**Developing
Papers.**

A developing paper then is one on which an image is secured by exposure and development. They include Bromide papers, papers of the Velox type, Platinotypes, Carbons and Blue Prints. Of these, blue print paper is used principally for prints of plans and drawings, it not being well adapted to views and portraits. Platinotype is an expensive mat surface paper which

gives excellent black and white effects and a most permanent print. Carbons are also expensive and more troublesome, but have a soft pleasing surface and can be made in most any color. They can be transferred to substances like china, wood and metal. Bromide papers are used chiefly for enlargements; and gaslight papers, of which Velox is the most generally known, afford a convenient means for making prints when daylight is not available.

**Printing-
Out
Papers.**

Printing-out papers are so called because an image is brought out in its fullest strength on them by continued exposure under a negative. They include such gloss papers as Lithium and Solio and such mat surface papers as Aristo Platino. Papers of this class are always subjected to a process of toning. Developing papers may be toned, but are not ordinarily. Printing-out papers fall into the subdivisions already indicated as gloss (glossy surface), and mat (mat surface). The gloss owe their particular surface to a heavy coating or sizing of gelatine. Before the day of these gelatine papers, the profession used albumen paper almost exclusively and it, having a comparatively light sizing, was softer and less glossy than gelatine papers. In fact, it was superior in every way, but when prepared for printing, would not keep over a day or two with ordinary care. The worker was therefore obliged to prepare it every time he printed. As the preparation was both disagreeable and inconvenient, the great convenience of a paper that could be bought ready prepared and

kept for months brought out papers which have led to those now commonly used. The first to come into extensive use was a collodion surface paper called Aristotype. It had an extremely glossy surface, so much so that it was easily scratched. Such an objectionable feature, combined with the harshness incident to a high gloss, brought about attempts at a paper with less gloss, and in this way the Aristotype was gradually superseded by gelatine papers. The gelatine surface was still highly gloss, and with that better taste which follows the novelty of something new, the manufacturers began putting out mat surface printing-out papers, of which Aristo Platino has held the lead since their introduction. But as between gloss and mat surfaces, one has not superseded the other and never will. For some commercial and reproduction purposes, a mat surface cannot equal gloss, and with negatives of a certain quality gloss papers give better results. The more mat or dead a surface is, the less it reflects and the less brilliancy it has. So a negative which leans to flatness and lack of vigor, as by overtiming, undertiming, or underdeveloping, would best be printed on gloss paper. But on the other hand, a vigorous overharsh negative would give its best results on a mat surface. These instances will serve for general application in printing.

Exposing	vs.	In a broad sense, the employment of any means by which light may have access to a photographic preparation is exposing. But the exposure to light of those preparations which are visibly affected by it is
Printing.		

distinguished by the term printing. Printing is done in only one way—by placing a printing surface in contact with whatever is to be represented thereon. That surface is the film on papers and plates, which film must always be in contact with the surface on which the original is represented. And so, in printing from plate to paper, they are placed film to film. So also in exposing from plate to plate or from plate to paper, the placement is film to film, whether the exposure be by contact or otherwise.

How Negatives are presumed at the outset
To Print. to be in printing condition. (See pp.
103 and 104). To print, clean the glass side, dust off the film, and, placing the negative in a frame, lay paper on it so that plate and paper will be film to film, as directed above. Avoid touching the printing surface of any paper. Handle it by the edges as nearly as possible. With the frame back fastened in, lay the negative in a good light and look at it from time to time to watch the progress of printing. In opening a frame, use two hands, pressing evenly on the spring, lest it flip out and crack the negative. Two other precautions are necessary: Do not open a frame in a strong light nor move the print. If a print must be looked at while outdoors, it should be carried to shade, or, at least, shaded by the position of one's body. Take but a momentary look. Both ends of a print ought to be watched to see that all is going well and to average the final depth of the print; for often opposite ends vary greatly in this regard. As to the other precau-

tion, the chances of moving a print are not great if a person cultivates the habit of opening a frame easily and lifting the paper at its edges instead of pulling. Sometimes the springs on a frame back are not stiff enough to hold a print. If so, bend them up a little. A soft cloth pad is a good means against moving prints.

**How Long
to Print
Gloss
Papers,** The time required for either exposing or printing is gauged by the final visible results. The method of determining the necessary amount of printing, then, is by comparing the depth of finished and unfinished prints. Gloss papers are found to lose but little depth in finishing, and the rule for them is to print until they have reached the depth that would suit one if the picture could remain that dark; then, two shades deeper will allow for finishing. (See pp. 103 and 104).

Within limits, the proper depth for a print is a matter of one's own choice. Shadows should remain detailed and not be blackened to dark patches, nor should a print appear light and faded. Stating it another way, a print should be dark enough for vigor but not to the extent of overprinted shadows. Make only a few prints for the first trial and keep them in a dark place until ready for toning.

**Means
Toward
Special
Results in
Printing,** There are preliminary steps which may be taken for securing certain effects in printing. Tissue paper is often pasted over a frame to strengthen the printing qualities of a negative. The same means

may be employed to tone down the contrast of a vigorous negative or to soften the lines of retouching.

Heavy shadows can be subdued by brushing the tissue with prussian blue over those parts. Brush it on as evenly as possible, and if the work is moderately well done, the unevenness will blend out because tissue is raised from a negative.

Negatives are also masked at times, and at other times, vignetted. Masking is done by printing from a negative with a shape of regular or irregular outline placed over it. This prints the picture within a sharply defined white border. Masks are cut out of thin opaque paper. When they are used, the printing paper should be pressed in contact with a pad of blotter, felt, or rubber cloth. The pad ought to be used in all printing. By vignetting, a picture is printed within a border whose edges are not sharply defined, but blend into the picture. To vignette, cut the shape wanted out of cardboard and slit and turn up the inside edges. Next, determine the position for cardboard on the outside of printing frame by holding up the frame to light with back removed and negative in place. Then tack the cardboard in position. This will vignette if printing is done in the shade; but to blend edges in direct sunlight, the shape should be covered with tissue paper. When this is done, the opening in the cardboard need not be exact, only approximate, and the exact opening wanted can be shaped on the tissue by brushing on opaque while holding frame and negative the same as for bluing.

Trimming. Amateurs often neglect trimming and oftener leave it undone until after toning. But unless prints are to be left unmounted, trimming should be done before toning, for economy of both time and material. Laying each print face up on a glass, and another glass over it, trim off all ragged edges and undesirable streaks of white or black with a sharp knife. Square the corners successively with the top glass. Or, hold the print against a glass and trim around with shears. A print trimmer does the work more conveniently. When using a trimmer, lay a glass over the print and its edge will then cut straight. Slanting lines may sometimes be corrected by trimming, and mussy or peeled edges should always be cut off. Do not neglect trimming. The appearance of otherwise good work is often spoiled by lack of it.

Washing; Toning; Fixing.

Making a
Print
Permanent. If a print were left as it comes from the printing frame, it would soon darken over; for the same condition which makes it susceptible to change when exposed under a negative makes it susceptible to further change if exposed to light apart from the negative. In order to preserve a picture approximately in the form it has after printing, it must undergo a process which is known by the general term, toning. And under the term in its general sense are included the processes of preliminary washing, toning (in the restricted sense), fixing and final washing.

Only a part of the silver in a paper is colored during printing, and practically the whole process necessary

to making a print permanent consists in clearing the paper of unused silver. Some of what is not used will wash out. As an initial step, then, the prints are washed. Fixing would complete this clearing. But, while it is true that clearing away unused material is all that is necessary toward making a print permanent, its appearance can be greatly improved by toning, which brightens the whites and improves the color of a print, so that, instead of a disagreeable yellow, the color may vary at will from cherry red to blue. Toning cannot be done after fixing, and on the other hand, a preliminary washing is very necessary to successful toning. Therefore the order—washing, toning, fixing.

Equipment And Baths for Toning Gloss Prints.	Washing trays.	Alum, saturated sol.
	Toning tray.	Powdered borax.
	Fixing tray.	Blue litmus paper.
	Gold chloride.	Funnel.
	Hypo.	Absorbent cotton.

See toning list, last chapter, regarding size and kind of trays, etc. Make all solutions before washing prints and keep hypo by itself. Be even more careful about washing hypo from hands than when handling negatives. The least trace of it on a print will cause yellow stains.

Gold Stock Solution. In 8 oz. narrow mouth bottle:

Water (pure)	8 oz. or 240 cc.
Gold chloride	15 grains or 1 gm.

Toning Bath. In 32 oz. wide mouth bottle or 1 qt. Mason jar:

Water (pure) 24 oz. or 720 cc.

Gold stock solution 6 dr. or 23 cc.

Borax enough to make the bath neutral or slightly alkaline. Dip in a piece of blue litmus paper and when it shows no change or slightly bluer tint, the bath is in good condition. If the litmus paper shows the least tinge of red, add more borax. Bath should be mixed one hour before using.

Alum Solution. Half fill an 8 oz. wide mouth bottle with alum and fill up with water. Shake to dissolve.

Hypo Solution. Mix same as alum solution.

Preliminary Washing. This washing and subsequent toning should be done in subdued light. Draw water into one of the washing trays and immerse the prints one by one. Keep them stirring and well separated. Observe the milky appearance of the water, an evidence of silver washing out. Pour off this in two or three minutes, and to the second wash water add 1 oz. of alum solution (saturated solution) for every quart of water. This wash should last several minutes, until the prepared surface of the paper has toughened. Feel film to notice the difference. Let several more changes of the water follow at intervals of a few minutes (or leave water running) until the milkiness has entirely disappeared and the whole washing has lasted at least twenty minutes. When a large number of prints are handled, it is best to pass

them from one wash tray to another at each change to insure separation and complete change of water.

Toning. The temperature of a toning bath should always range from 60 to 70 degrees and should be neutralized according to directions.

Pour the toning bath into its tray and transfer one print to it. The print will take on a bricky color for a moment, but thereafter the first action of the toning bath is to clear up the whites from their tawny color. The next thing noticeable is a softening of the intense red in a print and its gradual change to blue.

After a print has cleared in the whites, the color at which toning should be stopped is entirely a matter of taste with the individual. Avoid extremes, of course. A warm tone of bluish red is commonly considered best. The toning should occupy six to ten minutes. The formula for this bath may not contain gold enough for some papers. So if it works slowly, add gold. If too fast, add water. Having tried the bath with one print, run through the rest, throwing them out into water as they tone, until all are ready for the fixing.

Fixing. Make a fixing bath by adding two oz. of hypo solution (sat. sol.) to every 24 oz. of water (a bath about 14 grains strong). Immerse prints in this and keep them well separated during the entire fixing of twelve to fifteen minutes. Prints discolor when first dipped into a fixer but soon regain their color if the bath is in normal condition. An overstrong bath bleaches prints. Observe again

the caution about hypo. It must not touch other baths, or prints, until they are immersed in it.

Hardening. Hardener is usually added to the fixing bath, but it is better to rinse the prints from fixer and harden them for five minutes in the same tray with 1 oz. of alum solution to 24 oz. of water.

Final Washing. A final washing of one hour in running water finishes up the process. This may also be done in the hypo tray. Two hour's washing in standing water will suffice, if water is changed several times during the first half hour and again at the finish.

Discussion. *Preliminary washing.* A preceding paragraph noted that washing, toning and fixing is the necessary order for these respective processes. In toning, gold precipitates upon a print and takes the place of some of its silver, which, in turn, passes into the toning bath. Now if there were no preliminary washing, a part at least of the gold would be wasted in replacing unused silver, which is not essential to the picture and would have washed out in water. So without a preliminary washing, the strength of a toning bath is weakened to no purpose and its action necessarily dies down with lack of gold, causing waste of time and material. More than this, any material left in a print which is not essentially a part of the image mars the brilliancy of that image. Thus there are both economical and technical reasons for thorough preliminary washing.

Toning. The color of a gold precipitate in a neutral bath is blue. The silver deposit on a print is

red. A blue substance then takes the place of a red substance and this accounts for the change of color as toning proceeds. But in an acid bath, the color of the gold precipitate is somewhat reddish, and as a reddish gold would change the color of a red print less than a blue gold would change it, an acid toning bath retards change of color. For another reason, too, an acid bath is not suited to the purpose. If a certain amount of silver were replaced by an equal amount of gold, the darkness of a print would evidently be little changed. In case, however, gold replaced twice its amount of silver, a print would lighten decidedly in toning, seeing it receives but one part for every two it loses. As a matter of fact, the condition of a toner does vary its replacing power, an alkaline or neutral bath replacing less silver than an acid bath. From this appears the second reason against an acid bath—it will bleach prints. Looking at the other limit, a bath may be too alkaline. Such a condition favors flatness, lack of brilliancy; but the balance of reasons is decidedly against the acid bath. Favor alkalinity. Hard and soft effects in toning are incidental to the foregoing facts. Any tendency toward bleaching having in consequence a tendency toward hard effects; and contrariwise, softer effects result as bleaching conditions are avoided. Litmus paper should be left in the bath during toning because prepared printing-out papers are more or less acid and may necessitate the addition of alkali.

As to rapidity of toning and constant separation of prints in the bath, the first item should find its limit

somewhere within six to ten minutes. Too slow toning, especially in warm weather, will result in a mushy looking print, and too rapid toning is apt, for one thing, to leave a print only superficially toned, so that when the fixer is applied and the under surface of print shows its color, the whole print is too red; and for another thing, it is difficult to get an even tone in a quick bath, blue and red streaks resulting. These last defects are also the argument for keeping prints in motion and well separated; for gold precipitation occurs unevenly on a print whose portions are variously free from, or in contact with, other prints.

A word about temperature will recall the remarks among developing exercises concerning the natural resistance of a gelatine surface and the resulting tendency toward brilliant results in cooler baths and toward mushiness in warmer ones. The gelatine body is so much thinner in papers than plates that the temperature of toning baths cannot take a greater range than 60 to 70 degrees without marked retarding one way or detriment to the print the other.

Fixing and final washing. The fixing bath serves the same purpose that it does with negatives—to clear out all remaining unused silver. It clears out a much larger per cent of silver than all the preceding washes and baths combined, and should therefore be very thorough. For that reason, you are cautioned to keep prints separated during the entire fixing. Unless hypo, too, is thoroughly removed, prints turn yellow and fade in time. The same necessity for

separation of prints during the final washing is therefore apparent.

Hardener is a means of keeping the coating firm while prints are in solution and of avoiding sticky surfaces which catch dirt when prints are mounted and stick to ferrotype plates when squeegeed. It is recommended to use the second hardener after a rinse from hypo rather than during fixing. There is less risk of color change in the hypo. Warm weather necessitates an increase of hardener.

Squeegeeing Prints. When gloss prints are to be left unmounted, they can be flattened and polished on a ferrotype plate.

Prepare the plate by flowing it with a solution of paraffin in gasoline, a piece the size of a pea to a quart of gasoline. After rubbing the plate clean from what is left by this flowing, lay wet prints on it and thoroughly squeege out moisture and air bells with a blotter and roller. When dry, they will easily peel off or release of themselves. Flaky spots that appear after squeegeing are due to lack of contact, air bells not squeegeed out; sometimes also caused by imperfections in the surface of the ferrotype. If prints stick, use more hardener.

Paste for Mounting. Those who use mounting paste only occasionally can buy it ready prepared, if they prefer. The following makes a paste that will keep several mouths: Mix 1 oz. of silver gloss starch with 1 oz. of water, then add 8 ounces of water in which is dissolved 22 grains of lump alum. Add also seven or eight drops of oil of cloves and heat the whole until it thickens, stirring

constantly. Let it cool, and then strain through cheese cloth.

A good paste that will keep for a few days only is made by pouring boiling water on silver gloss starch until it thickens to the consistency of jelly. Let it cool and then strain as above. Paste must be clean and free from lumps.

Mounting. Mounting should be done in good taste. Wide borders about a print display it favorably, but are not always convenient for mailing purposes. At any rate, one can use judgment in the choice of card and be cleanly in the work. Poorly trimmed prints and mussy mounting are an eyesore. The style of cardstock frequently changes, but a person is always safe in choosing soft and plain shades of grey. White cards soil readily and are apt to harden the appearance of prints, especially if enameled.

Unless the suggestion to trim before toning was followed, it will be necessary to lay out prints between lintless blotters or clean, white paper, until they are dry; then to trim and wet up again. If ready for mounting, cover a glass with a clean sheet of wet paper and lay the prints face down on it one on top of another. Drain off and squeeze out all the water that can be conveniently with a cloth and roller. Then, pasting the top print, lift it from glass to mount and rub it down into perfect contact, using for the purpose a sheet of clean white paper and a print roller. Brush the paste evenly over the whole back of print and pick off any grit, lumpy paste, or brush hairs that

lodge. Look for such lumps again after rubbing down and remove by lifting a corner. In placing the print on its mount, hold it by diagonal corners and centre with the other two corners. Be careful not to hold by the edges of a print in lifting it, for that rubs off paste where it is most needed. Should the prints stick to paper and gather dirt or the films peel up at edges, there was lack of hardener. Lay the mounted prints between clean white paper until dry, when they can be burnished. If the paste is too thin or prints too wet, they will peel up at edges in drying.

Those who wish mounted and polished prints but have not access to a burnisher, find it necessary to squeegee before mounting. It is difficult to mount squeegeed prints flat and clean, but a comparatively convenient method is to dampen the back of each one with a sponge or cloth just enough to make it pliant before pasting. Squeegeed prints are often mounted on cheese cloth by mounting the cloth as soon as the print is rolled out on the ferrotype plate. The print then peels off with its mount.

Spotting Prints.

After prints have dried, photographers touch out the white spots which result from defects in a negative or from the dust and dirt that clings to a plate during printing. The method of covering them corresponds to that in spotting out pinholes from negatives (page 104), except that Indian ink alone can only be used for prints in black and white. The color of the spotting medium is suited to prints in red and brown shades by mixing carmine with the black ink.

Burnishing. After spotting, prints are shaped and polished in a hot burnisher. They must be bone dry, and, preparatory to burnishing, be lubricated to heighten gloss and prevent sticking between the rolls. To lubricate, rub a soft pad against castile soap and pass it several times over each print. A burnisher roll should be heated to the same temperature at each end, and when heat has reached the sissing point it should be turned down enough to keep the roll at that temperature while in use. An overheated burnisher reddens prints and softens the film so that it rubs, while an underheated roll fails to impart a gloss. Adjust the rollers to the thickness of a mount and roll through each print six or eight times, bending up the card gradually as it passes through. The polish is dulled a trifle if prints are laid in a pile before cooling.

Mat surface prints are also shaped; but not polished. To prevent smoothing of the dull surface, they can be placed face against an extra card and rolled through a cold burnisher.

What Is a Good Print? The test of a good print is that it reproduces all that the negative shows in highlight and shadow and reproduces it also to the best advantage possible with the given negative. This is practically the test applied to a good negative, that it represent the original in detail most advantageous to the subject. And as it was observed that a negative is more exactly called good when so called with reference to a particular paper, so also it may be said that a print is good or

bad with reference to the negative from which it is made.

How to Get Good Tones. The prime lesson to learn at the outset in making positives is that a good print may be got from a good negative but cannot be got from a poor negative. Do not become entangled with difficulties which are incidental to a poor negative, not the fault of paper or toning. Because poor prints do not always indicate poor negatives, the study of negatives was made from proofs rather than toned prints, thereby excluding poor results which might be incidental to toning. To simplify the study of prints and print making, be careful to select only good negatives for practice work.

In *purchasing* paper, one should see that he is getting fresh stock. The slightest tinge of yellow is enough to condemn any printing paper as too old for the brightest prints and clearest tones. An old paper prints slowly, tones markedly slower than fresh paper and requires more toner. This, too, with a final result which is inferior to that obtained on fresh paper.

The conditions of the toning and fixing baths have somewhat to do with the results obtained *in point of softness*. When a print lacks this quality (has harsh and glaring whites; deep shadows; fails to reproduce all that the negative shows), it may be that the negative is too harsh for the paper, but even in case it is, the print in hand may not be the best possible on that paper. The toning bath may not have been neutral or the fixing bath might have been too strong and bleached the whites. Many poor prints

result from overstrong hypo bath, and if pictures are found to lack softness, are not mellow, dilute the bath and note result. A bath is not the right strength simply because it adheres to a formula. The real test is whether it turns out mellow and well fixed prints. Papers differ, and a formula given out for general use cannot always apply. For this reason, rest judgment on results rather than on the fact that a certain formula has been adhered to.

Often *the color of a print* is unsatisfactory and repeated trials fail to rid one of the objection, usually because the color seems all right when prints leave the toning bath, but not when they are dry. Wrong color may be due to overtone, undertone, or, there may have been proper toning but subsequent faulty conditions. An overblue color results from too long toning or from failure to thoroughly immerse prints when they leave the bath, which allows toning to proceed. But if prints are a noticeably redder shade when taken from the hypo than they were from the toner, and yet a clear cherry-like red, no brown tinge, the circumstance would indicate that toning had been too rapid, was only superficial. But again, when the fault is not so much a decided reddening as a brownish tawny appearance which did not appear until the prints went into the fixing bath, a remedy lies with that bath and not with the toning. If the browning is accompanied by excessive bleaching, this labels the difficulty as wholly, or at least partly, due to too strong a fixer—dilute the bath. But still there may be browning. If so, it is likely due to too acid a hypo bath—

neutralize partially with sod. bicarbonate or sod. carbonate. Sometimes also the use of hardener in the fixing bath instead of separately changes the tone.

Other objections arise in the shape of blue or red spots or unevenness in the tone. They are ordinarily due to too fast toning or failure to keep prints moving in the bath, and sometimes the spots are caused by finger marks. A slow toning, bleached, pink colored print indicates an acid toner. To test the action of an acid toning bath, acidify a portion of a good bath with a few drops of nitric acid. There will be a decided bleaching action on the print.

**Toning
Outline.**

1. *Preliminary wash.* Five changes of water, lasting at least twenty minutes. Hardener in the second water—1 oz. alum (saturated solution) to 1 qt. of water.

2. *Toning bath.* Water plus stock gold plus borax and test with blue litmus paper, which must remain blue. Too slow, add gold. Too fast, add water. Special care against an acid bath. The bath may be used for two or three tonings if filtered back into the bottle and strengthened with gold each time it is used.

3. *Toning.* Prints must clear in whites. Tone to satisfactory color.

4. *Fixing.* Bath—10 to 14 grains strong—1 oz. saturated solution of hypo to 12 oz. water. Bleaching, too strong a bath. Special care against too strong bath. Fix twelve to fifteen minutes.

5. *Hardening.* Rinse well from fixer and harden

for five minutes—1 oz. saturated solution of alum to 20 oz. water.

6. *Final wash.* One hour in running water. Two hours in standing water, with changes.

CHAPTER XI.

PLATINUM	<i>Platinum toning.</i> Equipment the same as for gloss toning and, in addition;
PRINTS.	Platinum stock solution—in 6 or 8 oz. narrow-mouth bottle.
BLUE	
PRINTS.	Water 6 oz. or 180 cc.
CARBONS.	Pot.-chloro-platinite 15 gr. or 1 gm.
	Citric Acid 40 gr. or $2\frac{2}{3}$ gm.

Or, substitute 20 gr. or $1\frac{1}{3}$ gm. of phosphoric acid for the citric acid. Phosphoric acid is more commonly used, but sometimes irritates the skin. Or again, "Aristo Platinum," a ready prepared solution, can be bought and used as directed on the bottle.

Platinum toning bath.—

Water	20 oz. or 600 cc.
Platinum stock solution	3 dr. or 11 cc.

The bath should be made a half hour before it is used. It may be used repeatedly if filtered back into the bottle and strengthened with stock solution at each toning.

How to Print The usual rule given for printing
Platinum Aristo Platino is to print it until
Toning Papers, the whites of the view or of face
 and drapery brown over slightly. But
 it is difficult to state a definite direction for general
 application. The paper lightens so much in the toning

process that untuned prints are about twice as dark as one would wish them when finished. The rule mentioned may be followed with negatives of medium contrast, and in that case, when whites brown over, deep shadows will be green. But prints from flat negatives brown in the whites before the shadows turn green, and if carried farther will darken beyond all chance of clearing, thus destroying the little brilliancy possible with such a negative. Opposed to this, a very contrasty negative would show much green before the lights brown over, necessitating a compromise between shadows and highlights. Take as a rule then, that for ordinarily contrasted negatives, the printing of Aristo Platino should be continued until whites brown over and the whole print seems about twice the desired depth of a finished print; that for flat negatives, a lighter appearing print is better; and that for an overcontrasty negative, a darker appearance than the average may be favored, but not to the extreme of sacrificing shadows.

Toning
Aristo
Platino.

The general process of toning this mat surface paper corresponds to that followed in toning gloss papers. There is, however, an additional toning in platinum following the gold toning and the hardening bath used in the wash water for gelatine prints may be omitted, Aristo Platino having a collodion emulsion coating which is insoluble in water. The coating of even gelatine mat surface prints is not readily softened by solutions because it is imbedded in the paper rather than an overlying body.

As a result, less hardening precautions are necessary. The same gold toning bath may be used that was made up for gloss prints (See pg. 168), and every direction in regard to the preparation and handling of that bath for gloss prints applies with equal force when using it for Aristo Platino. The clearing of whites and change of color toward blue occur as when gloss prints are toned, although the red of Aristo Platino has a brown cast. After toning in the gold bath, these prints are passed through another toning, the platinum. The color obtained in this bath depends upon how much gold toning a print has had. A short gold with full platinum toning imparts a greenish and not very clear tint to shadows. A medium gold tone with full platinum brings the shadows to a clear gray and excessive gold toning finishes them up in platinum with a dull gray and flattened highlights. The clear result obtained after medium gold toning is the most desirable. This medium tone corresponds to what is commonly termed a slightly warm tone, which might be described as one that has passed entirely beyond the clearing of highlights and retains a brownish red with an undertone of blue.

Prints are thrown into water from the gold toning, as usual, and when all have passed through, the same tray may be used for platinum, after a thorough rinsing. For thorough platinum tones, prints should be left in this bath until every particle of red is gone from the shadows. One has only to watch the shadows and continue toning until no trace of red remains. Prints brighten to some extent, if left a

little longer than the observed disappearance of red; not however, if the gold toning was incorrect. In determining the correctness of gold tone by the final color of a print, all one needs remember is that a greenish shade indicates too short, and a blue, too long gold toning.

To get these differences clearly in mind, take one print out of the gold bath immediately upon clearing of whites before the redness has softened, another print when it seems to answer the description of correct gold toning, and a third, only after excessive gold toning has given it a decided blue color. Carry these three the same length of time in platinum, gauging time by finishing of the correctly gold-toned print.

A tray should be well rinsed from platinum toner lest it interfere with the next gloss toning.

See toning outline, pg. 187, for fixing.

Silver Prints. Platinum toning is not necessary to a print except for a black and white effect. A print can be fixed and washed directly from the gold toning and be fully as finished as one having the additional platinum tone. The only difference, beyond color, is that one remains entirely a silver image toned in gold, the same as a gloss print, while the other is more or less platinum, according to the amount of platinum toning it received. Papers toned in a platinum bath are called platinum-in-the-bath papers to distinguish from platinotype, which has platinum in the paper.

Silver-Platinums.

Plantinotypes.

**Red Spots
in
Toning.**

Some difficulty is experienced with Aristo Platino prints by reason of red spots which appear during gold toning. They are often the result of careless handling which greases the printing surface in places, thus preventing the toning solution from penetrating into an emulsion. Old paper has a decided tendency toward these spots and it is reasonable to think that fingers have then little to do with the difficulty. An emulsion hardens with age, not a mere physical hardening, but what amounts to the same thing for toning purposes, there is a state of emulsion which resists toning action. Should this hardening occur in spots, the red spots find one more source. A remedy sometimes recommended is to touch the spot with a drop of platinum stock solution, or, one not too pronounced will often come out by lengthened platinum toning. That is about all that can be done with them after they are discovered, but in case red spots become a usual occurrence in platinum toning, a three minutes soak in very dilute soda bath, say $1/4$ oz. sod. carbonate, or borax, or sod. bicarbonate to a quart of water, would tend to rid one of the spots provided they be of an acid nature. But too strong a dose of the alkali would result in muddy tones. Such a bath should constitute the first water of the preliminary wash.

**Single
Toner.**

A single toner is sold for the convenience of those who consider separate toning baths too much work or difficult to manipulate. But it is not recommended. It does

not give a clear platinum tone, leaving rather a brownish tint in the shadows. And moreover, the separate bath method will not be difficult for one who faithfully follows directions until he has seen the differences pointed out and gone through the work a few times.

Toning Outline. Aristo Platino.	1. <i>Preliminary wash.</i> Five changes, covering at least twenty minutes. Harden in second wash only in warm weather—1 oz sat. sol. alum to 1 qt. water. If troubled with red spots, use
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alkali in the first water of preliminary wash.

2. *Toning (gold).* Same as gloss toning bath, water plus gold plus borax, testing with blue litmus paper, which must remain blue. Tone to a slightly warm color. Pass prints to water.

3. *Toning (platinum).* Same toning tray well rinsed. Bath—water plus platinum stock solution, no borax or litmus paper. Tone till no red in deepest shadows. If red spots appear, tone a long time. Pass prints to water.

4. *Fixing.* Hypo bath—15 to 18 grains strong—1 oz. sat. sol. hypo to 10 oz. water. Fix fifteen minutes.

5. *Hardening.* Five minutes. One oz. sat. sol. of alum to 20 oz. water.

6. *Final wash.* One hour running water, two hours standing water, with changes.

Platinotypes. The subject of platinotypes is quite thoroughly treated in special publications on that subject, and this article does not pretend to add any facts nor to consider the subject at greater length than is needful to fulfil the plan of this

work, which aims to present a systematic course and be a working guide in all the processes which ordinarily take up the attention of camerists.

The platinotype is the first topic in the order of these exercises which involves the making of positives by a developing method. A feature of it which differs from any other process discussed in these notes is the indirect means of securing an image. In all the rest, the substance in the paper or plate from which the final image is produced is acted upon directly by light; but as yet, no process has been introduced in which a platinum image is secured directly by the action of light. The vigorous black and permanency of a platinum image are advantages, however, which have led to the perfection of the platinotype process by which an image is first secured in iron and from that in platinum

**How the
Image
is Secured.**

The paper is prepared with a surface which contains a form of iron and a form of platinum. Light prints an image in the iron, and the particular form of iron of which this image is made up is capable, when in a solution of potassium oxalate, of precipitating, as a dark deposit, the platinum included in the preparation of the paper. That part of the iron surface, however, which was not exposed to light, and hence not changed by it or become a part of the image, is not capable of such a result. When, therefore, a solution of potassium oxalate is poured over this exposed iron-platinum paper, platinum precipitates wherever the iron has been acted upon by light; that is,

in the form of an image. Potassium oxalate then is the developer for platinotype paper. But to retain a purely platinum image, the iron must be removed, and whatever substance will dissolve the iron becomes the necessary clearing solution or fixer. In this process, hydrochloric acid serves the purpose. It must, however, be used in very weak solution.

**Usable
Age
Limit.**

Platinotype paper spoils readily and should be kept entirely from moisture. The manufacturers therefore seal it in tin receptacles, which contain a moisture

absorbent, and stamp the date of output on the outside. The rapidity of spoiling varies with the season and place of keeping, as of plates; but on the average, one should use platinotype paper within six weeks of the recorded date. It would pay a person to lay aside a sheet of platinotype paper for a few months and then print to see the muddy result. The object lesson is of value, because when one sees this pronounced muddiness, and considers that the same effect results from old and inferior stock in other preparations, it has a tendency to impress the advantage and economy of using fresh stock.

**Manipulation and
Baths.**

Although the results obtainable on platinotype paper are among the best that can be obtained by any photographic means, its manipulation is comparatively simple.

A piece of paper may be cut into several strips to use in making trial exposures until the correct exposure is obtained. The image is semi-apparent

when fully exposed; the shadows and middle tones are easily traced, but highlights are barely distinguishable. The paper is exposed in a frame as in ordinary printing, and the length of exposure amounts to about a third of that necessary for gloss papers. The same methods of bluing, masking, vignetting, etc., can also be resorted to, if necessary. Overexposures develop dark and muddy; underexposures, faintly.

For developer, mix a saturated solution of potassium oxalate (neutral), and if it is not already above the temperature of 60 degrees F., it should be warmed to between 60 and 70 degrees. The temperature of the developer is an important item in this work. Heat decidedly lengthens the exposure effect, while a developer at a temperature much below 60 degrees develops a very weak image. Heat has a tendency also toward a warm tone. A vigorous black is a desirable tone to most workers.

Develop by immersing a print in the solution. Leave them in from fifteen to thirty seconds, passing them from that directly to the fixer (1 oz. hydrochloric acid to 60 oz. water). Fix for four or five minutes and pour off the solution for a fresh supply, in which they should remain ten minutes. After this, a fifteen minute wash carries them to a finished state, as far as baths are concerned. Notice the loss of yellowness as they remain in fixer, an evidence that the iron is being dissolved. The developer can be kept for use at another time, and after use on several occasions should be replaced by new; but if those occasions are widely apart, use fresh each

time. Developer is sometimes applied with cotton, especially for purposes of local development.

Blue Prints. Akin in part to the platinotype process is the making of blue prints. The image preparation on this paper is a form of iron which is acted upon by light and changed by it into a form that makes a blue compound with potassium ferricyanide when the two are together in solution. Potassium ferricyanide is the developer in this case and water becomes the medium of development. The paper is usually prepared with the developing agent already in it, and therefore needs only to be dipped into water after printing. For this reason, water itself is often called the developer.

The unused iron that remains after image development is washed out by a few minutes soaking, and the print is then ready for drying. Because it needs but water to affect the development of paper prepared in this way, it spoils readily if kept in a damp place.

Blue print paper is used very largely by manufacturing establishments as a convenient and inexpensive means of duplicating draughtsman's work. It is also prepared for amateur use, the preparation for that purpose being such as to give less contrast.

Its manipulation is simple. Printing lasts a few minutes, to a semi-apparent image, and development is affected by dipping the print in water, which at the same time becomes a fixer by washing out unused material. After a fifteen minutes wash, a print may be hung up to dry.

**Carbon
Prints.**

The carbon process is not related in principle or method to any other means of securing positives, nor is it included in the practice of the majority of either professionals or amateurs, largely because of the difficulty of its manipulation, which also puts carbons above the average price of other prints. The line is not profitably taken up unless one has time to practice it to proficiency and, for this purpose, special literature on the subject is obtainable. The following notes on the process are included as outline information, not as directions:

The basis of the process is that of the insolubility in water of a gelatine body, if treated with potassium bichromate and exposed to light. Wherever light reaches a gelatine body that has been immersed in a solution of this substance, that body becomes insoluble in water, and insoluble more or less deeply into its structure, according to the amount of light that reaches it. If the exposure is made under a negative then, the thickness of insoluble material varies with the transparency of portions of the negative, and when soluble portions are washed away, there remains the insoluble film, of which the thin and thick parts represent respectively the highlights and shadows of an image. In a colorless film, the varying thickness would scarcely be distinguishable; but in a colored film, the thick parts give a heavier tone of the color, and therefore appear as shadows in comparison to the other portions. Color is supplied to a film by including a coloring pigment in its preparation. The pigment is entirely or partly made up of Indian

ink or lampblack (forms of carbon), and hence the term, carbon process.

The permanency of this class of prints depends upon the permanency of the pigment used. A purely carbon print has a permanency that places it far above silver prints, and as its texture and the possibility of its transfer to any supporting substance are points greatly in its favor, the process stands high among the means of photographic productions.

**The
Carbon
Process.**

Briefly stated, the process is as follows:

The printing surface, or tissue, as it is called, is prepared by coating a paper with pigmented gelatine. The sensitizing with potassium bichromate is usually done in a separate operation, as needed. It is done by immersing the tissue in a solution of potassium bichromate in water, to which alcohol and a little ammonium chloride is added. Sensitizing is done in a darkened room and the length of time recommended for immersing the paper varies from one and a half to three minutes. After this, the tissue is fastened to a board with tacks driven half way at the corners. The drying occupies six or seven hours and must be in a dark, cool, and well ventilated room.

The tissue is exposed as in ordinary printing, always, however, with a mask covering the edges of the negative, in order that development may be accomplished without tearing the film. There is no visible change in exposure. The time required is ascertained by trial and averages about one-fourth the time for printing gloss.

The exposed tissue is then placed in water, and in a moment, brought in contact with the support on which it is to be developed. Paper supports can be bought, but if the support is to be china, wood, metal, or anything of that sort, it is flowed with a five grain solution of gelatine, and long enough beforehand to be dry when needed. As soon as brought into contact, the tissue and support are squeezed together, as in ferrotyping, and allowed to set for ten or fifteen minutes. They are then developed in water at a temperature of about 100 degrees F., the support down. Soon the lower part of the sensitized coating softens enough to let the paper back be peeled off. Then, continued rocking of tray and pouring water across the print gradually clears away soluble gelatine, leaving the insoluble image film in contact with the support. Water becomes the fixer, because it washes away unused material.

When washed clean, a print can be soaked a half hour in cooler water, then a few minutes in hardening solution (page 181), and again a little washing before it is dried.

The single transfer described reverses a print because it presents the opposite side from that which was printed. If necessary to remedy this transposition, a double transfer is made. The single transfer support, in this case, is waxed over previous to the contact, so that the print may crack loose when thoroughly dry. Then, when the clearing and washing has been finished as usual, the print is brought into contact with the next and final support, and let dry.

CHAPTER XII.

**GAS
LIGHT
PAPERS,
ENLARGE-
MENTS.**

While papers like Velox, Cyko, Uko and Dekko do not give results on a par with platinum prints, they nevertheless meet a large need. It would be impossible at times to get prints at all except on a gas light paper, and then of course, the slight inferiority is more than overcome by the convenience of the article.

These papers are manufactured in several grades distinguished by a difference in surface, smooth or rough; in color, black and white or sepia; and in contrast, those prepared for portrait work giving least.

The general procedure in making these prints corresponds to that in making a negative. The relations of exposure, restrainer, developer and development, and the manipulation of developers, apply with them as with plates, the details within each process differing only in points that are incidental to the use of paper or plates.

**Manipulation
of
Gas Light
Papers.**

A print is exposed, developed, quickly rinsed and passed to the fixing bath. The exposure is by contact, film to film, as in printing. The film side curls in. The paper may be handled in a room closed from daylight but having weak artificial light,

as a gas jet half on. Unused paper should be kept covered and the piece in use shaded, until exposure, by the position of one's body.

At a half foot from a gas mantle light, negatives of average density vary in exposure from ten to thirty seconds, an ordinary gas jet, incandescent, or oil lamp requiring much more time. Always ascertain the exposure for a negative by trial on small strips. To get like exposures, one should be careful to hold a negative at the same distance from the light each time. Also, by moving it to the right and left, no part of the negative will be brighter lighted than another. At times, however, it is advantageous to let a brighter light expose on one part of a negative.

In developing, there are but two items new to those already emphasized: one, that these papers must always be developed with bromided developer to preserve clear whites, and the other, that the color of shadows varies with the amount of bromide, as well as the kind of developer used. A clear black, or gray black, is got by the use of a metol-hydrochinon developer, with just enough bromide to keep whites clear; but an excess of bromide tends to tinge shadows green. Developers are sold for these papers, and one is at a choice between them and mixing his own stock. Either will give good results. See formula, page 18, and proportions for use, page 84. Pyro cannot be used.

Prior to development, a print should be soaked in water until pliant. This is to prevent white spots, marks and streaks, which result from uneven penetra-

tion by developer. The developing is quick work, the time for it averaging from fifteen seconds to a minute.

Fixing should occupy twelve to fifteen minutes in a fresh bath about twenty grains strong—2 oz. sat. sol. of hypo to 16 oz. of water. Use acid hypo or add a few drops of acetic acid. This is to prevent brown spots which often appear in these prints.

Exercise. This exercise will serve only with developer which contains no bromide in the stock solution. Add bromide only as directed in the examples.

Equipment. Two negatives, one of average density, the other very intense; one dozen of paper for soft effects, one dozen for hard effects; metol-hydrochinon developer; 10 per cent. solution of potassium bromide.

Mix four ounces of developer and put equal portions in two bottles. To one, add two drops of ten per cent. bromide (not more). Cut a sheet of paper for hard effect into several strips, using these for trial exposures. Expose and develop trials from the less dense negative until a print of good depth is made, using the bromided developer. If the whites are not clean, add one drop of bromide solution. Having found the correct exposure, use it whenever the following examples call for it. Prior to immersion, let each print soak in water until limp. Make all the exposures on full pieces and number them according to notation of examples:

1. Make one good print on a full piece—using the bromided developer.

2. Expose four times longer than the correct exposure—same developer. Notice the general darkness but comparatively clean whites—indication of correct developer but overexposure.

3. Make a correct exposure. Add ten drops of bromide to the same developer and develop with that. Notice development, light print, green shadows—indicating too much bromide.

4. Make a correct exposure. Use the developer left in a bottle without bromide. Notice the quick development, and muddy whites and that the print is darker than number 1, although exposed the same.

5. Make a correct exposure. Add the same amount of bromide to the developer used for 4 that was added to the first developer with best result, and develop. Notice good depth and clear whites, resembling print 1.

6. Make a trial exposure with the dense negative and then print a full piece. Develop with developer for 5 and notice (probably) not clear whites—showing, if there was not excess bromide to begin with, that dense negatives require more bromide to preserve clear whites during the lengthened exposure.

7. Make a correct exposure, from the first negative, on portrait paper (soft effect). Notice that it requires less exposure than the other paper. Make another exposure, correcting the time, and notice in this good print the difference between it and the good one on the other paper in the contrast they present, showing that the softer paper is suitable for harsh negatives and any other subject which,

by its nature, needs favoring toward soft effects, as a portrait.

Thus far the points of the exercise are principally applicable to work with gas light papers, but they may serve also, with those that follow, to emphasize the possibilities in all developing. A possibility not particularly adapted to developing papers but of general value in developing, is included in the following example of this exercise because these papers show it readily.

8. Take two ounces of the developer stock solution without potassium carbonate. Add two drops of potassium bromide, shake well and pour equal portions into separate bottles. To one portion, add one half the usual amount of alkali (pot. carbonate or sod. carbonate) and to the other, add four times the usual amount. Notice, with less carbonate, the slower development, clear whites, lighter print (if equally exposed); with more carbonate, fast development, not clear whites, and darker print.

**Supplemen-
tary to
Exercise,**

Beside the items mentioned, two difficulties are commonly met. The paper for soft effects often develops black streaks; these are caused by friction on the prepared surface at some time prior to development. To see that it can be caused in this way, rub two halves of a sheet together, and expose and develop one. When these streaks come on a background or run faintly across a picture, they may be cleared with very weak reducer, but some care is necessary lest the print be bleached and all softness destroyed. The

best way to manage it is to lay the print from hypo into a tray with just sufficient water to cover it; then apply weakened reducer quickly with cotton, rinsing the print under a tap after each application. The other difficulty is that a print will, at times, be a brownish shade, especially when a developer has been used for some time. This is because the developer has become oxidized by use and exposure to air. Throw it away and use fresh. More than this, the brown spots from fixer, (page 197), and white marks from failure to previously soak paper should be guarded against.

Discussion. The rapidity of Velox developing is the first difference that breaks away from the rut of dry plate developing, and upon this difference hinges the necessity of bromide for every print. The rapidity itself is due to a lack of body in the emulsion. A plate coating is so heavy that its consistency retards penetration by a solution. The particles imbedded within it are therefore protected from sudden developing action, the physical restrainer being sufficient for all but overexposures. But in the absence of sufficient physical restrainer, as is the case with these papers, resort must be had to a chemical restrainer. Otherwise, the unrestrained developer acts freely upon both light product and unexposed emulsion, thus obscuring an image in developer fog.

Because unexposed emulsion lies in the shadows of a negative and in the highlights of a positive, bromide preserves clearness chiefly in the shadows of the former but chiefly in the highlights of the latter,

in either case, holding back one part while another proceeds.

The color effect of bromide on developed prints indicates that it has a color value whenever used in developing. In the trial with overbromided developer (example 3), the color value of bromide is plainly green. A tinge of this color may not be objectionable, but the usual aim in print developing is toward a black and white effect.

One should be careful to throw away developer as often as there is any indication of browning. Four ounces of metol-hydrochinon will, with ordinary care, develop a dozen or more good 4 x 5 prints; but not if the developer is left lying in a tray for a long time. Do not overwork a developer. There is always more lost in prints by such methods than is gained in developer.

In the development with different quantities of potassium carbonate, a small quantity gave the effect of a short exposure and a larger quantity the effect of a longer exposure, accompanied by some muddiness in the whites. The increase of alkali therefore would seem to permit a decrease of exposure, but favor muddiness. Alkali and bromide then have opposite tendencies. Alkali accelerates, bromide retards; alkali tends to softness, bromide to harshness; alkali tends to produce developer fog—muddiness, bromide tends to prevent it—clearness. This comparison is not made to recommend the habit of varying the amount of alkali. Ordinarily, one stands on safer ground in using a medium quantity, which any approved for-

mula should recommend. But once in a while, a radical change of subjects would necessitate a change in the proportions, but only a little. Refer to page 83 for the recommended proportions for different subjects and conditions.

Enlargements The general subject of enlargements would partly include and extend beyond the field of photographic processes.

Portraits in oil, pastel, water color and crayon may be made independently of any photographic process, but all these forms of portrait pictures are at this day largely worked over on an image secured photographically. Portraits in oil are done on photographic prints only to a limited extent, while those in pastel and water color are ordinarily worked-over prints. And the amount of free hand crayon work is less than insignificant beside the amount of good, bad and indifferently worked up prints. Even wash drawings do not escape the time-saving groundwork that a print affords. And while it may be urged that the cheapness of this method has led to such universal use, there can be no question but that they secure proportion and accuracy of outline difficult to free hand work.

The three classes of prints which furnish groundwork for enlarged portraits are known as platinum prints, silver prints and bromide prints, the first two being often designated as solar prints. They are both in black and white, with images respectively of platinum and silver, as their names would indicate. Their introduction long preceded that of the general class,

bromide prints, which, in their turn, were the fore-runners of Velox and papers of its kind. Velox is occasionally used for enlargement work but is not intended for the purpose, and, being very slow as compared to bromide paper, cannot be used except with an arc light.

**Solar Prints
and
Bromide
Prints.** If unworked solar and bromide prints were placed side by side, the obvious difference would be faint, rough and unfinished pictures in the former case and full toned finished pictures in the

latter. Solar prints require a great deal of finishing by hand. Bromide prints are usually worked up and more exactly worked up than worked over, for very little work is done to them in comparison to the work necessary for finishing solar prints. The so called crayons which sell at cheap rates are, as a rule, these worked up bromide prints. Not that a bromide print is necessarily a shoddy article, but it no doubt becomes so after conversion into the usual cheap rate crayon. For many purposes, bromide prints, or bromides, are very desirable and have reached a state of excellence in the hands of experienced workers that credits the paper with just merit. The comparatively finished condition of a freshly developed print makes it available as an enlargement process for persons who would be entirely at sea were it necessary to work one over in crayon. For this reason, the making of enlargements as a topic for general workers specializes into directions for making enlargements on bromide paper.

**Method
of
Enlarging.**

The method of enlarging is by projection, corresponding to the method of projecting stereopticon views. There is a source of light behind a negative, and the light, passing through this negative, passes also to a lens just forward of the plate, by which lens it is projected upon the screen. As light passes through different parts of a negative more or less completely, it is projected with greater or less intensity, and thus forms an image in gradations of light and shadow. This image, of course, corresponds to that through which the light is thrown. Bromide paper must be exposed in a dark room and handled by the same ruby light used in plate work. The exposing light is therefore entirely shut off after focusing and until the paper is in place for exposure.

Bromide enlargements can be made in a copying camera by fastening the paper to a glass and placing this in the holder like a plate.

**Fixings
for
Daylight
Enlarging.**

For amateur purposes, a small window space may be used for exposing light, the rest of the window being carefully screened off with brown cardboard or dark cloth. The space should be small enough for the back end of the projection box to lap it by about half an inch all round. A reflecting cardboard fastened outside the window at the bottom of the opening for light evens the illumination on a negative.

Apparatus.

A long focus *camera* will answer for projecting apparatus. It should be set

on a bed between two parallel slats so that it may be slid forward and back, and the bed itself should be six inches longer than the camera fully extended. The ground glass end of camera is pushed against the window. Without a ground glass, everything seen through the clear portions of negative and window would focus on the screen. Cut the division card of a plate holder to let light pass through, and, when ready for work, place negative in the side of holder farther from ground glass. Or, to save holder, make a little frame that will slide into the plate holder receptacle.

Those who have not a camera with an extra long bellows, such as a long focus camera has, can remove the ground glass from their folding camera or view box and fit an open box over the ground glass end. This box must have a ground glass fastened at its end toward the window, or, white tissue paper over the light can be substituted; and about an inch in front of this ground glass, or substitute, the box should have an opening in its side into which the negative frame may be slid. In case different sized negatives are enlarged from at different times, the frame can be the size of the largest negative and kits used for the smaller sizes, as in plate holders. Have the length of this box such as to increase the distance from lens to plate holder by five inches. A lantern slide copying camera is already fitted with these kits and is also adapted to enlarging with artificial light, but with window light, it would be necessary to use ground glass or tissue paper over the window opening.

The further apparatus necessary is a *focusing screen*, which serves also as a support for the sensitized paper. It is an upright of board or heavy pulp board, of dimensions to allow several inches over the largest enlargement made. It may rest on a bed some six inches lower than the camera bed. The upright cannot be stationary. It must slide forward and back to increase and decrease the amount of enlargement, and must therefore be built with a base which slides between two parallel slats on the bed, just as the camera slides on its bed. These beds for camera and screen must of course be parallel to one another and the upright be perpendicular to its bed (figure 20). The necessary lengths of projecting box

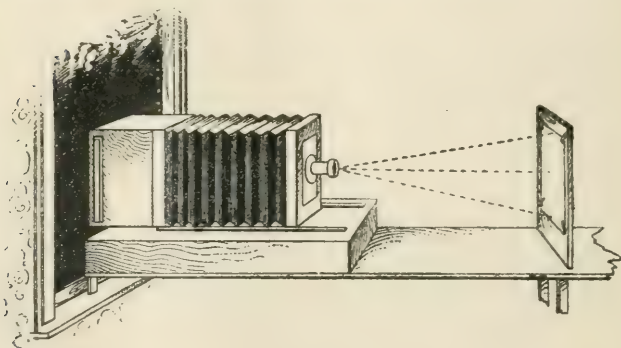


Fig. 20.

and screen bed vary with the focal length of the lens used. If the image cannot be made large enough when the bellows is fully extended, it indicates the necessity of a longer box, or, of a shorter focus lens

with the same box. The length of box indicated in the preceding paragraph answers for 8 x 10 to 16 x 20 enlargements from negatives 4 x 5 to 5 x 7 and with lenses having a focal length anywhere from six to eight inches. A screen bed for 8 x 10 enlargements should extend four feet forward from the lens when 4x5 to 5x7 negatives and lenses of six to eight inches focus are used. For sizes larger than 10 x 12 a longer bed is necessary. Six to eight inches covers the focal length of most folding camera lenses. To determine the approximate focal length of a lens, focus on the object at some distance and measure the distance from centre of lens mount to sharp image.

**Enlarging
by Artificial
Light.**

The window outfit will do for occasional use, but professional workers and others who care to invest in more convenient fittings supplant window light with a good artificial light and condenser. The artificial light is usually an arc, although acetylene gas and lime light, as used for stereopticons, may be employed.

Again, there are those who find window light inconvenient or unsatisfactory, and yet cannot afford an arc and condenser. For such, a substitute is recommended after the manner of figure 21.

The light should be as many candle power as can be had. If gas, use mantles; if electric, use 50 candle power, or several sixteens, before each shaft. Line all the walls of the light shafts with smooth white cardboard or paper, and place some sort of reflectors behind the lights. There is no necessity of ground

glass with this light arrangement. The negative may be fastened in the end of the middle shaft, or, as in window light directions. With a strong light, this arrangement makes the work very easy.

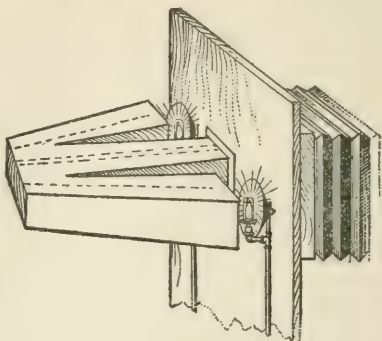


Fig. 21.

Figure 22, representing the regular apparatus, shows a condenser fitted into a partition and a ground glass slid before it. Two ground glasses at one and two inches from the condenser are better. They distribute the light evenly over it.

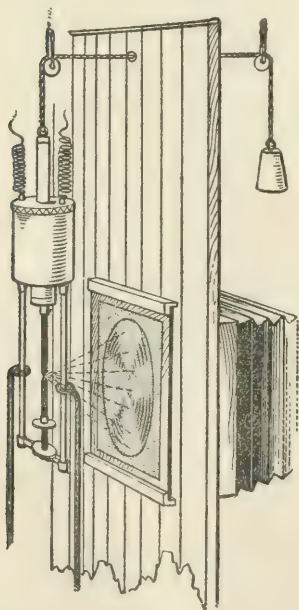


Fig. 22.

A *condenser* consists of a pair of condensing lenses which, for enlarging work, are usually mounted in tin. This makes a cheap and convenient mounting because it can be put on with a flange for fastening to a partition or board. Condensing lenses must have

a diameter equal to or greater than the diagonal of negative enlarged from. A $3\frac{1}{2} \times 3\frac{1}{2}$ negative requires a condenser of 5 inches diameter; a 4×5 , of at least 6 inches; a 5×7 , of at least 8 inches (better, 9 inches); and a $6\frac{1}{2} \times 8\frac{1}{2}$, of 11 inches.

Centre a light with the condenser at a distance equal to its focal length, measuring from centre of condenser mount. The condenser must also centre with the camera lens as well as be perpendicular to the camera bed.

When arc lamps are used, the arc is thrown out of centre as carbons are consumed. This makes it necessary to centre the lamp laterally and hang it from a pulley directly overhead, so that it may be pulled up or let down as an arc changes. The lateral centering should be made stationary by ring braces between which the lamp frame may slide. And if the pulley rope is put through a hole in the partition, the centering may be regulated from the enlarging room while one is watching the screen. Or, a lamp that keeps the arc automatically centered, as a stereopticon lamp, can be used. Whatever the lamp, it ought to be a self feeder to insure a steady light. When the light is out of centre, colored bands appear on the screen, bands at the right or left indicating lateral displacement, and bands at the top and bottom indicating perpendicular displacement. The light as projected on the screen should be white to the edges.

Another convenience would be *fasteners* for the paper, made of clock spring and screwed to each corner of the screen board (see figure 20). With a

length of six or eight inches and screwed down at only one end so as to move around that point, these spring pins are adjustable to several sizes of paper.

If a *lens* is purchased for enlargement work alone, let it be one with a thumb screw attachment on the tube, which attachment serves for fine adjustment in focusing. For enlargements up to 16 x 20, it should have an aperture of two or three inches and be at least a $4\frac{1}{4} \times 6\frac{1}{4}$ lens. An 8 x 10 rapid rectilinear or view lens is best for enlargements above 11 x 14, and will cover up to 18 x 22. A 4 x 5 folding camera lens will do for 8 x 10 prints from 4 x 5 negatives. The size of lens that one can use, as 4 x 5, 5 x 7, or 8 x 10, is gauged by the size of negative used, not so much by the amount of enlargement.

Bromide Paper. Bromide paper is made in three surfaces; smooth, medium and rough. Use the smooth for general work in small

sizes. It can be purchased in packages of cut sheets or in roll. The paper has been used to some extent for contact work, but has rather fallen before gaslight papers for that purpose.

Manipulation. Whatever the apparatus, close up the room and without inserting a negative, project a flood of light on the screen. Mark the exact center of light field with a cross and from this as a center, mark out a diagram $8\frac{1}{2} \times 10\frac{1}{2}$ to gauge size of image in focusing. Now insert a negative in the camera and focus by moving the bellows. If the image is too large when sharp, pull out the bellows a little and move

the screen until in focus. If size is still wrong, pull out or push back the lens to decrease or enlarge image respectively and again move screen to a focus. By such adjustment, get image focused in desired size and stop down, if not sharp enough. Cap the lens, fasten a small trial piece of sensitized paper within the rectangle marked on screen (by means of thumb tacks or springs) and expose.

The exposure should be much shorter than for Velox under the same conditions, numbering seconds where it would number minutes.

Bromide paper also develops slower, having a heavier coating. But otherwise, the handling of this paper is practically the same—enough pot. bromide to keep the whites clear but not enough to green the shadows. Iron developer is used a great deal for bromide paper, but it must be followed with a weak bath of acetic acid and water to prevent yellowing of the whites. As metol-hydrochinon gives good results and does away with the need of an acetic acid bath, it is well to use some such formula as that which has been followed throughout these exercises. See pg. 18 and pg. 84. Soak the paper in water, preparatory to development, until it is limp. From the water bath, it can be transferred directly to developer. Develop until the image is full and strong and pass it immediately to a 20-grain fixing bath (2 oz. saturated solution of hypo to every 16 oz. of water) for fifteen minutes. Finally, wash as in ordinary print washing.

**Mounting
Bromides.**

These prints are mounted on cardboard or stretcher. The paper is so heavy that it requires heavy pasting. It is well to let one coat of paste set and apply another. To mount on a stretcher, let one coat of paste set on both print and stretcher. Then paste print and mount.

**Finishing
Bromides.**

Finishing bromide prints is rather out of the province of any but crayon workers. One who has not done crayoning had better limit himself to scratching off black specks with a knife and to filling in white spots with a soft pencil. Literature can be purchased giving detailed directions for crayoning.

CHAPTER XIII.

**LANTERN
SLIDES.**

The reasonable aim in this work is to get a slide which shows plainly on the screen and shows particularly what is wanted in the slide.

Good slide making falls exactly in the line of good negative making. If a subject is flat, the aim in manipulation should be toward vigor, contrast and life; and if the subject is heavy in contrast, the aim should be to subdue contrast without losing life and vigor. The possibility of making a good slide depends as much upon the negative as does the possibility of making a good print, (pg. 95), and any negative which, by reason of its particular quality, produces a print that clearly carries out the object of the picture, will also make a slide which accomplishes its purpose to best advantage. The making of slides then reverts, in the first instance, to making a good negative. With the negative made, some opportunity for improvement, if any is necessary, lies in manipulating the plate, as in preparation for printing. (page 103). As far as negative making is concerned, the directions detailed throughout the chapters on that work apply as well to negatives for lantern slide purposes as to negatives for prints. The chapter on copying will be found especially adapted to making

slide negatives from book cuts, maps, etc. There is some latitude in density, but that strength especially which makes moderately clean mat surface prints, answers well.

**What is
Necessary
in a Slide,
Developer
for Slides,**

In particular, there are two requirements of every slide—transparency and vigor. A grey, dim and lifeless slide will not stand out clearly on the screen; at the same time, a deep dense one will not let light through and cannot therefore be easily distinguished on the screen. Because a slide must not be grey and weak, it should be fully exposed and be developed with a developer that gives a vigorous tone, and because also it must not be stuffed and muddy in either highlights or shadows, it should be developed under conditions which preserve clearness and prevent staining. Bromide preserves clearness and the possibility of stain excludes any such developer as pyro, which stains a plate even during a moderate time for development. As to developers that may be included, practice indorses ferrous sulphate from among the older developers, and such other developers as hydrochinon and eikonogen, or some combination of metol with one or both. The ferrous sulphate developer has given place to metol-hydrochinon for this purpose, just as it has for enlargements, and as this combination has become the generally accepted developer for slide work, some such formula as that on page 18, used in proportions indicated on page 84, is recommended.

**Adapting
Methods to
Subjects.**

Subjects for lantern slides fall into two divisions, those for contrasty and those for detailed results. Also, the common requisites for all subjects, as stated, are clearness and vigor, and therefore, the steps in manipulation turn either toward securing the greatest contrast possible while preserving clearness, or, toward securing thorough detail, clearness and vigor combined. It is a comparatively easy matter to get moderate contrast and clearness; because all the steps that aid a clear effect, work also toward contrast. But in the special necessity for contrast which such subjects as drawings, maps and diagrammatic work in general present, every possibility for it should be taken advantage of.

**Latitude in
Effect by
Plate Used.**

Presuming that the negative is made and ready for exposure, there are left only the possibilities within the method of slide making itself. The chances for difference in effect lie first with the plate, then with the developer, development, and after fixing, with reducer. The difference in lantern slide plates is wide, grading all the way from thin, lifeless emulsions to those that give heavy contrast. Among the leading slide plates on the market are the Carbutt, Seed, Eastman and Paget, the last named being an English make. In point of vigor, they work about in this order: Eastman, a soft, even tone; Paget (Paget slow), more vigorous, though not quite so vigorous as Carbutt, which itself gives less contrast than a Seed. These are the rough differences. Every good

plate has desirable qualities peculiar to itself and is adapted therefore to certain subjects when another would not be. Because then a plate does not develop a slide of desirable quality, that fact does not necessarily condemn the plate. It rather demonstrates the necessity of adapting plates to subjects, and this adaptation also would exclude all really poor plates. Slides of general views, historical and physiographical subjects, and the like, would best be made on plates of medium vigor, unless the negative happens to be weak or lacks moderate contrast, in which case a plate for heavier contrast is suitable. Charts, maps, etc., require all the contrast that can be got by any means.

**Methods
of
Manipulation.** Passing from plates to methods of manipulation, these apply generally, whatever the plate. The suitable kind and proportions of developer have been recommended. Full exposure and development have also been recommended. Sometimes a heavily contrasted negative will tempt a person to underexposure or underdevelop to subdue that effect, but exposure should nevertheless be full to favor highlights, and, generally speaking, development must be thorough to bring out the full gradations of an image. Any tendency toward underdevelopment will leave a lifeless slide. The toning down of contrast then falls back upon plate and developer, requiring a softer plate and a developer which gives less density; for a developer which contains less of the density agent can be carried to the full development of gradations

without plugging the shadows to a great extent. Ordinarily, however, a person has but one developer in stock and this plan is best, everything considered. The resort in that case would be to a little more alkali and water in proportion to the amount of stock used. For contrast, on the contrary, the resort would be to a little less alkali and water in proportion to the stock.

**Fixing Bath
for
Slides.**

The fixing bath should always be fresh to avoid stain. Occasionally a bath of full saturated strength frills a plate, but this seldom happens and the strong bath is better clung to for another reason. Slide plates frequently stain yellow, seemingly in the fixing bath. The trouble is due, in all probability, to an excess of bromide in emulsion or developer. The evidences of it are especially apparent in the unusually long exposures necessary for emulsions that stain readily and the unusual contrast that develops as well. Bromide has an effect upon unexposed emulsion that makes it less easily soluble in hypo. Consequently, the yellow stain will occur more readily in a weak fixer. When troubled with this stain, see that the fixer is a fully saturated solution and even omit bromide from the developer. The stain can be removed, if not too strong, by soaking the plate for a few minutes in a strong solution of potassium ferrocyanide (yellow), passing it to hypo again for a moment and then to the wash.

**Cleaning
with
Reducer.**

After fixing, a slide often requires cleaning with reducer, especially if it is a copy. Skillful use of reducer will improve an otherwise hopelessly muddy slide. If a plate were laid in a tray, the reducing solution would penetrate and reduce beneath as well as on the surface, thus weakening the image. But when it is applied with cotton, and the plate frequently rinsed, it cannot penetrate so much and there is consequently more nearly a surface action. Any muddiness, or extra density, which obscures shadows, lies at the top. So also with highlights, any muddiness in them resulting from the color of a copied page or lack of clearness in the original highlight is in the top part of the emulsion. A surface application then clears away undesirable parts leaving an image in good strength, and as, by this means, reducer can be applied either generally or locally, the method is doubly advantageous. Use only absorbent cotton for applying reducer. See page 49 for reducer and local reduction.

The extent to which reduction may be carried depends upon the subject. For views, very little, if any, is necessary. The use of reducer on slides is primarily to clean them and aid contrast. A free use of it should be avoided in anything but copy slides, because of the danger of cutting out detail. For line work, some at least is recommended, and for copies from books, especially when the cut is of an outline drawing, as is often the case with cuts pertaining to branches like Physics and Biology. If the subject is one that requires much reducer, exposure

should be lengthened some to impress an image more deeply into the emulsion. When a background is especially dirty, one should not try to clear it completely away from about the lines of a design, because this would reduce the lines as well. Do the work with very frequent rinsing and dipping in hypo. A thorough surface cleaning only is the safe limit. Always stop short of cutting out detail. A yellow bleached appearance results when reduction has been carried too far.

**Contact
and
Camera
Exposing.**

Slide exposing may be by contact or in a camera. From negatives larger than slide plates or too large for a slide plate to cover the parts wanted, a reducing camera is necessary. The regulation camera for this purpose is sold as a copying outfit for enlarging and reducing. See page 154. When the size of a negative permits a choice between contact and camera methods, the first consideration is one of quality, and the second, of convenience. Exposures by contact give more contrasty results, and, if a person is left to choice at all, the method of exposing may be determined by that fact. Contact work is also far more convenient. See page 29 for directions. The work with a camera does not differ essentially from enlarging. There is a projecting light, either window or artificial; but instead of throwing the image on a screen, it is focused on the ground glass and a plate exposed in the holder as in copying.

**Length of
Exposure.
Order of
Work.**

A slide plate is much slower than an ordinary. A negative of average density will expose a slide by contact in three to six seconds at a foot from a sixteen candle light. Expose, develop with bromided developer, fix in a fresh bath, reduce, if necessary, wash the ordinary time for negatives, then mat and bind.

**Matting
and
Binding.**

These operations can add largely to the appearance of a slide, but not at all to the quality. Mats can be cut by hand, but it is far better to buy them. For odd shapes and odd square sizes, it is best to procure blanks suitable for matting purposes and fit matting to figure by running a piece along each edge. To hold a mat in place, moisten the surface of the film, but only far enough in from the edge to allow the binder to cover its trace. See also that the mat squares with the subject. Mats have some means of distinguishing one side from the other, like a gilt line or white side. If the darker side is always placed against the emulsion, it improves the appearance of a slide by deadening bad edges, and having the same side always toward a film enables one to readily determine which side to place toward the lantern light. Thumb stickers are commonly used for this purpose.

A cover glass is fastened to the slide with gummed binders sold under the name of lantern slide binders. The thinner this glass, the less liability there is of breakage from heat. Spoiled slide plates can be converted into covers by stripping off the film. To do this,

soak them in a lye bath for a day, or, by heating, the film will scrape off in a few minutes. Scrape with a stick to avoid scratching the glass. Thoroughly wash the covers from lye before using them. See that each glass is carefully cleaned and the film of slide dusted before they are placed in contact.

Binding strips are easier handled if cut in two. Run a damp cloth over the gum, set slide and cover on edge and shape the binder over them, keeping its edge even. After the binder has set, finish by cleaning the glass thoroughly.

Slides should not be left long in a lantern, if freshly made. If they can be set aside for a few days, or run through the lantern slowly enough to warm through and then be set aside until thoroughly cool, they will season.

The notes of page 80 state some of the considerations which determine the adaptability of developers. The matter of color, which is important to this subject, was merely mentioned. An interesting trial of the color values of these developers, as well as their comparative speed in developing, may be had by mixing small solutions of each and developing a slide in each, timing exposures alike. The separate developers would not work to best advantage with the same proportions of sulphite and carbonate, but the rough differences can be noted in this way enough to see that, in respect to color, metol develops grey, eikonogen developing heavier, with a tinge of brown, and hydrochinon still heavier, with a deeper tinge of brown; and that, in rapidity of developing, metol develops

quickest and eikonogen much slower, though faster than hydrochinon. The incidental lesson of all such observations as these, which have been made as they worked in with the subjects of different chapters, is that each process widens the information on others and the general knowledge of all aids proficiency in special lines.

CHAPTER XIV.

DARK
ROOM.
EQUIPMENT
FOR
PHOTO-
GRAPHIC
WORK.

The *location and arrangement of a dark room* are not always within one's choice; but there are certain requirements which every room for that purpose must fulfil, and others which it would be well to include, if possible. In the first place, a dark room must be perfectly dark; no leaks from casings or cracks should be left unstopped, and the ruby light should be light-tight except through the ruby glass. Dark walls are safe; but white walls are risky.

Ventilation and heating.—Every dark room should also have means of ventilation and of heating in cold weather. Aside from the usual reasons for ventilation, the warm stuffy air of an ill-ventilated room in summer causes mushy development like that with warm developer, as described on page 54. A cold room, on the other hand, retards development, as with cold developer (page 54).

Fittings.—The barest needs in the line of dark room fittings are a water supply, developing bench and ruby light. Running water is to be preferred, though a barrel or pail supply will answer the purpose.

Developing lights.—The small *ruby lamps* sold for developing prove generally unsatisfactory, and are only to be recommended when it is necessary to

include a candle developing light as part of an outfit. The best dark room lights are what may be called *partition lights* and *box lights*. The former is illustrated in figure 23, where it rests on a bracket shelf just back of an opening in the partition. For loading plates and developing, the opening is closed with the framework, marked ruby, which hangs at the side. This is fitted with a ruby glass which is covered on the dark room side with a sheet of orange tissue. The tissue hides the flame from view and distributes the light evenly, so that when a negative is held up to it, its parts are easily distinguished. The ground glass frame at the right is exchanged for the ruby after fixing for inspecting negatives. A partition light is not only more conveniently arranged than a box light, but it keeps heat out of the dark room, a very important item in warm weather,

The difficulty with a box light, beside the objection that it heats a room, which objection it shares with the small ruby lamps, lies in the fact that there must be provision for inlet and exit of air. Such a provision is easily made with two one-foot lengths of 3 inch sheet iron piping which have pieces of sheet iron, of a size to fit two-thirds across, riveted to them at intervals on the inside. This will allow air to pass, but effectually obstructs light. The shape and location of these pieces are shown in A and B of figure. Use one of the pipes for inlet by fitting it into the side of the box, as indicated in figure, letting it lie inside along the bottom. Fit the other pipe at the top for exit.

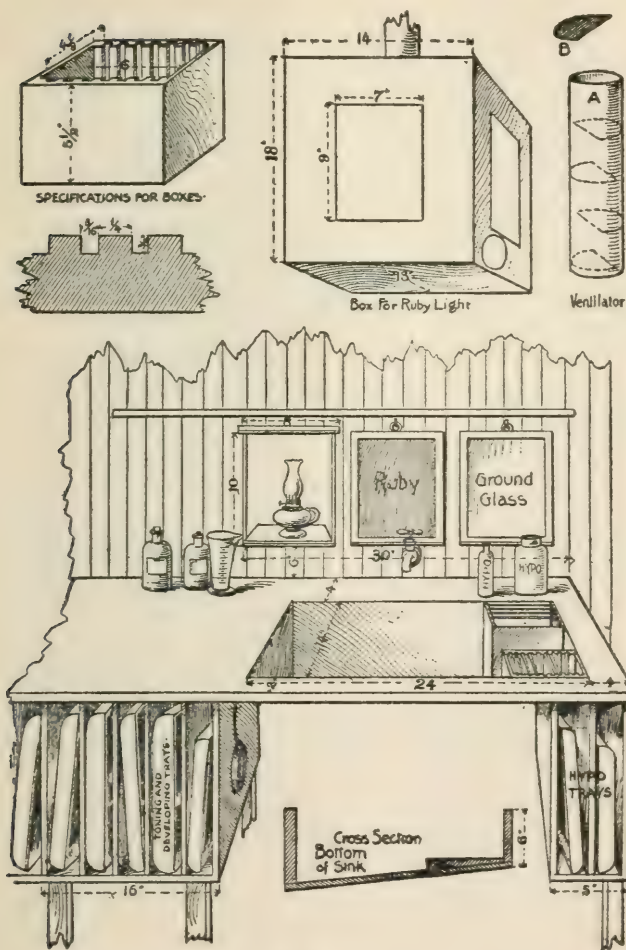


Fig. 23.

The sink should be built out about four inches farther from the wall for a box light. The box itself should be lined with asbestos paper and be the full dimensions indicated, unless the source of light is electric, in which case, it need be no more than eight inches deep, with a face eight by ten inches, nor need there be inlet and exit for air or changes in the dimensions of the shelf. A gas jet should set eight inches back from the opening in front, which may serve for access to light as well as the space into which the ruby and ground glass frames fit.

The *further fittings* which make a conveniently equipped dark room are also illustrated in figure 23. The measurements indicated can be varied to suit circumstances. It would be well, if convenient, to extend the shelf at the left of sink enough to give a width of two or three feet. The sink measurement is large enough to allow space for hypo and wash boxes for 4x5 and 5x7 plates. These boxes can be purchased or made of wood according to the specifications given, which are for boxes that will hold either 4x5 or lantern slide sizes. The material should be pine, at least one inch thick, tightly joined, and joinings white-leaded, if possible. Nail a narrow piece at the bottom on the inside to keep plates out of settlings. The inside width measurement gives four and one-eighth inches instead of four inches, to allow for swelling of wood. When running water is available, a hollow plug may be fitted at the bottom of the wash box for a rubber tube connection with the water tap. This gives an inlet at the bottom and overflow

at the top, which carries out dirt and insures a thorough change of water. Boxes for 5x7 plates can be made on the same plan, but must be of one and one-fourth inch stuff.

The sink itself may just as well be of wood as iron, if built with a slanting bottom, as indicated.

For a supply of standing water, the ledge at back of sink had better be three or four inches wider, making it wide enough to hold a crock or keg with a faucet extending over the sink.

The tray receptacle below developing bench need only be open rack work, and if set back a couple of inches, would be out of the way.

Notice that all hypo and hypo trays are located at the right. With hypo, reducer and intensifier bottles set along the ledge at right and back of the sink, and developer bottles all to the left, everything is conveniently placed and located in a way to avoid the liability of getting hypo in touch with things that must be free from it. A shelf over the partition light, extending the width of bench, would be convenient for stock bottles, toning solutions and the like. Its left end might well be left free to receive holders as plates are removed, and thus avoid wetting the slides. But the heat from a box light would necessitate keeping developer stock elsewhere in warm weather.

A tier of shelves and one or two drawers at another part of the room would be convenient for stock solutions, mounting material, negative storage, printing material, and the like.

**Lists of
Equipment.**

In making out these following lists of equipment, the purpose has been to name first all the necessary articles under their respective headings, with directions for those who prefer to buy things ready prepared, as far as possible, and also directions as to what one should be provided with for making developer and other things which are often sold in form for ready use. Beside this, the lists include extra articles, some of which find their way into most outfits, and others, desirable only to those who follow a certain line of work with a thoroughness for which all have not opportunity.

By writing down the articles enumerated under exposing, developing, intensifying, reducing, washing and drying, printing, trimming, toning, squeegeing, mounting and equipment for gas light paper, a list may be secured, by crossing out duplicates, which will fulfill the purpose of an entire outfit for general work. But it would not be advisable to include more than the necessary items until experience has shown what extras one may wish to use. A box of slide plates added to this list will equip one with material for most of the exercises.

A person who prefers to do no more than make exposures will need be provided with only the articles listed for exposing. Those who wish to do both exposing and developing, but not printing, will need the equipment for exposing, developing, reducing, intensifying, washing and drying negatives.

For Exposing. *Necessary equipment.*—Camera, tripod and plates or films. If plates are used,

get a camel's hair brush and extra plate holders. If a folding camera, get also a head cloth, unless the camera is used with film attachment only. (See page 7 for choice of a camera.)

A person should have a tripod, no matter what his camera may be. In traveling, it is sometimes necessary to dispense with one, but in that case, time exposures cannot be successfully made, and they are often necessary. The so-called snap shot camera cannot take a picture instantaneously, except of outdoor subjects in a bright light.

It happens that the comparative prices of plates is a pretty reliable index of their comparative qualities. The "cheaper but just as good plate" is a losing investment for anyone.

In buying films, mention the camera they are to be used with, in order to get the right kind.

One plate holder is always included in the price of a camera. Everybody finds need of at least three. Several kinds are made, the usual sort having a spring at one end against which the plate is pressed and let slip into place. A holder for one camera will not always fit another. Therefore, mention camera when purchasing holders.

The camel's hair brush is for dusting plates, before placing them in a holder, and for dusting negatives in printing. A two inch rubber-bound brush is best. A tin-bound and smaller brush would be less expensive and serve the purpose, if one is careful not to scratch the tin against a plate; but it would not be advisable to purchase smaller than a $1\frac{1}{2}$ inch.

A head cloth shuts off back light from a ground glass, enabling a person to see clearly while focussing. Fasten a rubber band or draw string along one edge to hold the cloth over camera.

Special equipment for exposing.—For cloud pictures, long distance views and operating in limited space, see pp. 100 to 102.

For copying, see pp. 151 to 154 and 158. See also "Isochromatic plates" and "Ray Filters," pp. 100 and 101.

For interiors, see "Long and Short Focus Lenses," page 102, also "Flash Light with Daylight" and "When to Use Flash," page 111.

For flashlights, see "Differences in Powders," "Methods of Using Flash" and "Flash Light Machines," pp. 112 to 114.

For commercial work, machinery, etc., see pp. 159 and 160.

For portraiture, see pp. 117 to 119.

Necessary equipment.—Developer, developing trays, graduate, pot. bromide (1 oz.) and ruby light. See page 223.

For Developing. Those who prefer to purchase prepared developer, had better get it in the powdered form, which requires only the addition of water. Do not purchase developer already in solution; for it keeps but limited time in that form, and may be already past use.

Those who prefer to make their own developer will need the following articles in amounts indicated:

$\frac{1}{2}$ lb. sod. sulphite crystals, neutral (in a bottle), keep stoppered; 1 oz. of metol-Hauff; 1 oz. hydro-

chinon; 1 oz. pot. carbonate, keep stoppered; 1 oz. pot. bromide.

Bottles—Two 16 oz. narrow mouth, stoppered—label “developer;” one 10 oz. narrow mouth, stoppered—label “pot. carbonate;” one 6 oz. narrow mouth, stoppered—label “pot. bromide;” one 4 oz. wide mouth, stoppered—label “old developer.”

A stew pan is also necessary. It should be granite or enameled ware and be used for this purpose only.

It will be necessary to have access to scales. If a pair is purchased, they need not be fitted to weigh over three or four ounces.

There are considerations for and against making one's own developer. It is less expensive, allows more chance for manipulation in work, and is by all means the intelligent way of working. But it necessitates more equipment, and unless the work is done with a moderate degree of accuracy and painstaking, the chances for advantage may be turned to disadvantage. The time required for this work is inconsiderable. For persons shifting from one place to another, the prepared powders are more convenient.

Trays may be rubber or composition. Get a perfectly flat bottom, if possible. The object of ribbed bottoms is to keep some solution under the plate, enabling a person to lift it more readily from the tray. But the lifting is easily managed by pressing against one corner and lifting from the diagonally opposite one. Several trays are necessary. One should be the size of the plate used, but not smaller than 4x5. This can be used for developing single plates, also for

purposes of intensifying and reducing, if thoroughly rinsed and left with standing water for a few minutes after either. Get also a tray large enough to hold two plates, and for one who does a great deal of work, a third tray, large enough to hold four plates, would save a great deal of time by allowing the development of that many at the same time.

For Reducing. Pot. ferricyanide (1 oz.); hypo and a red or covered bottle, labeled "pot. ferricyanide."

For Intensifying. Mercuric chloride (bi-chloride of mercury), 1 oz. or less; pot. iodide, 1 oz. or less; hypo, one 8 oz. wide mouth bottle, labeled "intensifier."

For Fixing. *Necessary.*—Negative fixing box; hypo, 5 lb.; lump alum, 1 lb. See chrome alum, page 91. For a small amount of work, this quantity of hypo will do. Keep it covered. A hypo box can be purchased or made, as described in dark room fittings, page 226.

Extra. Hydrometer, for testing the strength of solutions. See page 94.

For Washing and Dying Negatives. Washing box, bought or made (see page 226); clean cotton, for swabbing negatives, and a negative rack (see page 35).

For Preparing Negatives for Printing. The list under this heading may include equipment for spotting, and in portrait work, that for retouching also; but unless one has time to practice the work of spotting, or that of both spot-

ting and retouching, there is no need of investing in this branch of equipment. The same applies to necessities for bluing and opaqueing. See "Preparation of Negatives for Printing," pages 103-107, also "Equipment for Retouching," page 139.

For Printing. *Necessary.* Printing frames and printing paper.

A person should have from four to a dozen or more frames, depending upon the amount of work done. For an initial purchase, get four the size of plate used.

In paper, get a few dozen at the start and use sparingly until familiar with the processes of printing and toning. Other papers can be purchased as taken up in the exercises.

Extra. One frame, a size larger than the negative, would be necessary for any work like printing on paper larger than the negative. White tissue paper, scrap cardboard, thin opaque paper, prussian blue and opaque (page 106) may be used in special work. See "Means toward Special Results in Printing," page 165.

For Trimming Prints. *Necessary.* A print trimmer, such as sold in stock houses, or a glass and shears, or glass and knife. See "Trimming," page 167.

For Gold Toning. Washing trays, 2; toning tray, 1; fixing tray, 1; lump alum; gold chloride, 15 grains; funnel, 1 qt.; absorbent cotton, 1 oz.; powdered borax, 1 oz.; hypo; blue litmus paper; bottles—one 32 oz. wide mouth, or 1 qt. Mason

jar, labeled "gold toning bath"; one 8 oz. narrow mouth, labeled "gold stock solution."

Trays measuring 8x10 are large enough for those who use 5x7, or smaller, outfits and who do a small amount of work. Otherwise, they should be larger. They may be anything but tin or plain iron. Enameled or granite is most suitable and can be easily cleaned. Label trays and use each for its own purpose, never for anything else.

**For
Platinum
Toning.**

In addition to equipment for gold toning, a bottle of aristo platinum, one 32 oz. bottle, labeled "platinum toning," and a 4 oz. bottle, labeled "platinum stock solution."

**For
Squeegeeing.**

Squeegee plates and print roller. Do not get smaller than a six inch roll and have it a double roll.

**For
Mounting.**

Necessary. Lintless blotters or clean white paper; paste, (see page 174); paste brush, not smaller than one and one-half inch and rubber bound; card mounts.

See pg. 176 for equipment for spotting prints.

**For
Special
Processes.**

For gas light papers, see page 197; for platinotypes, see page 190; for carbons, see page 193; for bromide enlargements, see pp. 204-209; for lantern slides, see page 219.

**For
Miscella-
neous
Purposes.**

Lye, for stripping plates, (see page 221); sulphuric acid, (see page 91); acetic acid, (see page 197); alcohol, (see page 35).

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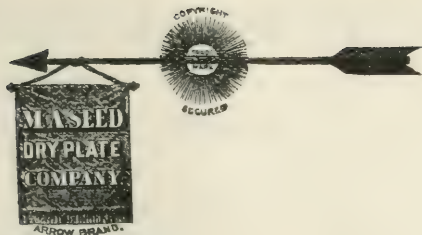
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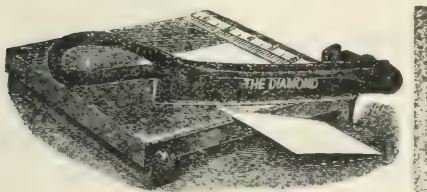
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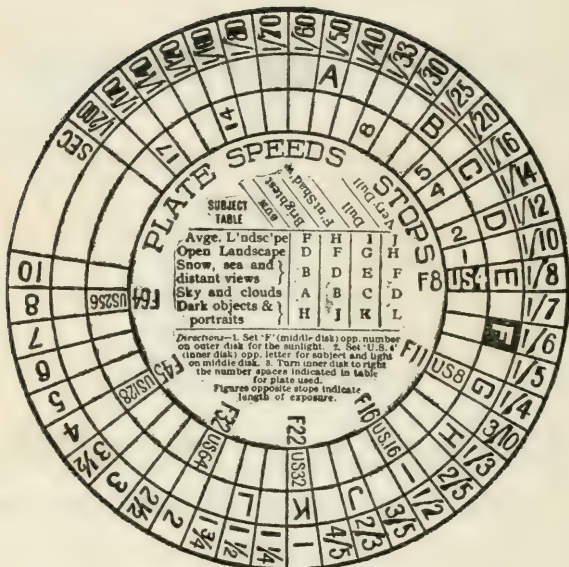
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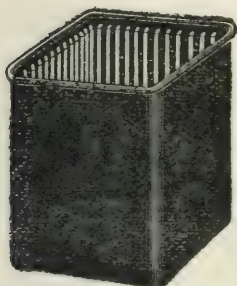
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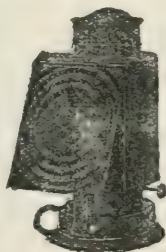
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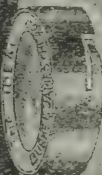
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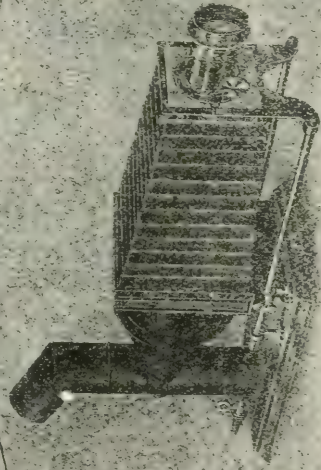
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